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NOVEMBER 194

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IR

LITERATURE

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TRIMMING TREES WITH AIR POWER

Original pruning tower built by California fruit grower to improve orchard work

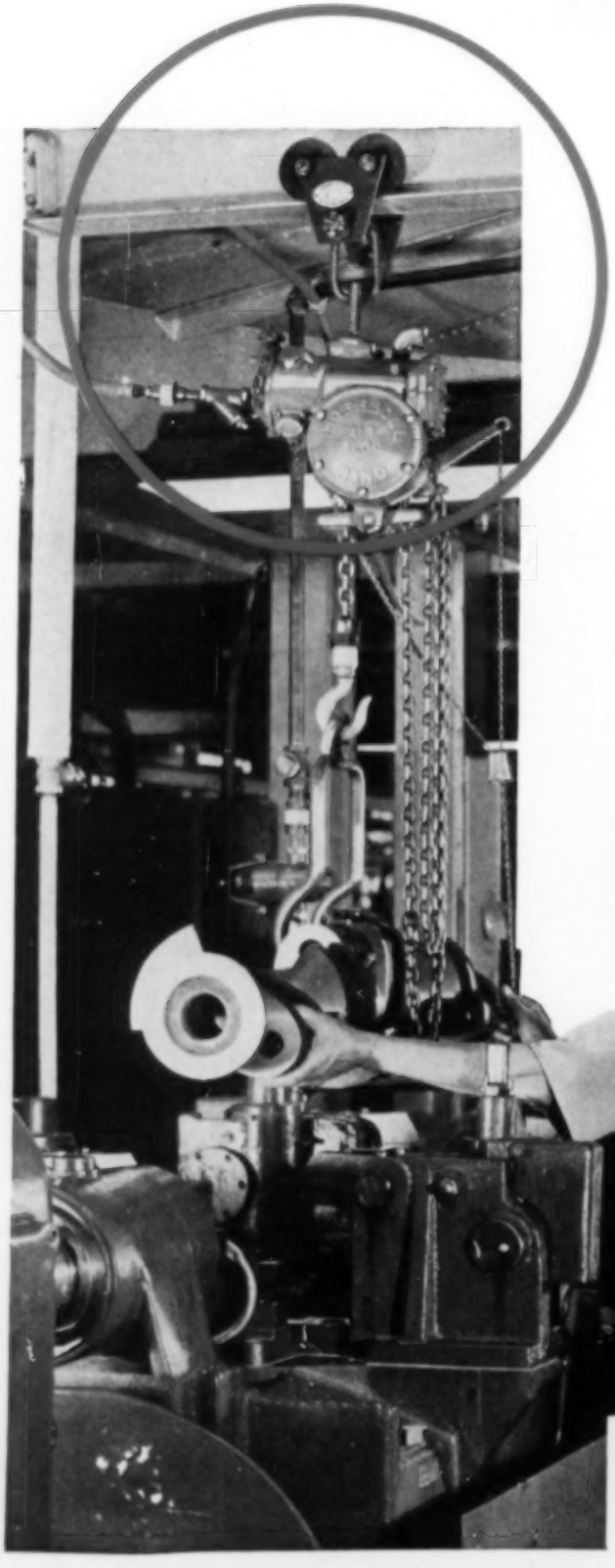
(See Index Page and Page 262)

VOLUME 53 • NUMBER 11

NEW YORK • LONDON

AIR HOISTS

PAY THEIR OWN WAY

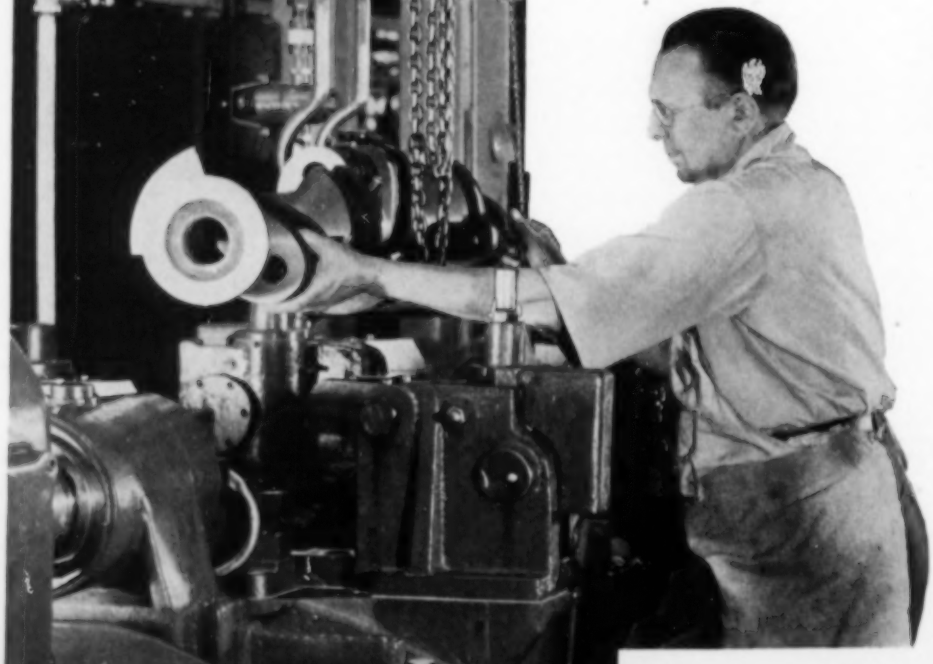


Every time a man picks up material, moves it, and puts it down, it adds to your production costs, yet adds exactly nothing to the value of your product. With today's cost of labor, it's only common sense to make sure your lifting and moving operations consume as little time and effort as possible.

For rapid and easily controlled lifting and moving, use job-proven Ingersoll-Rand Air Hoists; they cut production costs and now pay for themselves nearly twice as fast under today's conditions.

I-R Hoists are designed to operate with an absolute minimum of maintenance. Many I-R Hoists have been in service for years with no attention except routine lubrication; reliability is inherent in their design.

Available in capacities from 200 to 20,000 lbs., these hoists give complete and accurate speed control—from full speed to a smooth crawl—and the sturdy air motors can't be harmed by overloading or use in hot and gaseous atmospheres. Call your Ingersoll-Rand branch office for complete information, or write for Form 5020, "Hoist and Haul With Air."



AIR POWER
The Key to Lower Production Costs

IR *Products*

AIR TOOLS
•
COMPRESSORS
•
ROCK DRILLS
•
TURBO BLOWERS
•
CONDENSERS
•
CENTRIFUGAL PUMPS
•
OIL & GAS ENGINES

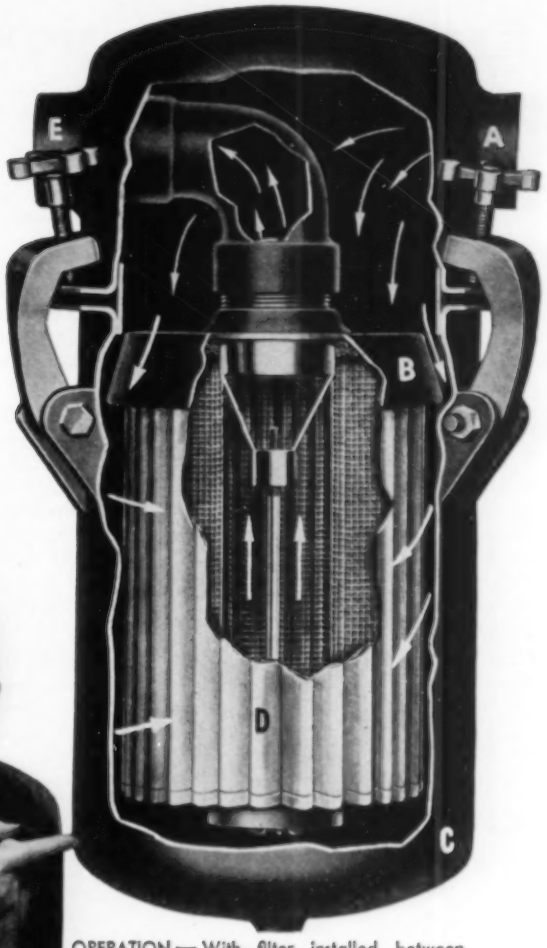
317-B

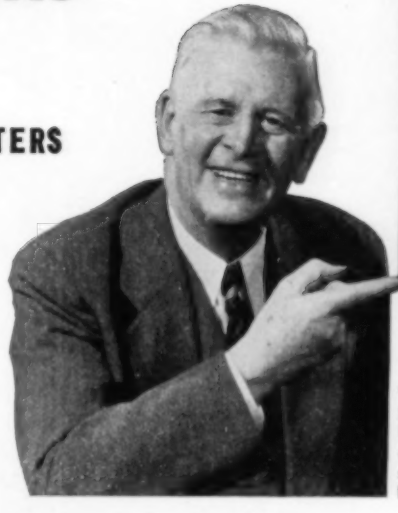
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

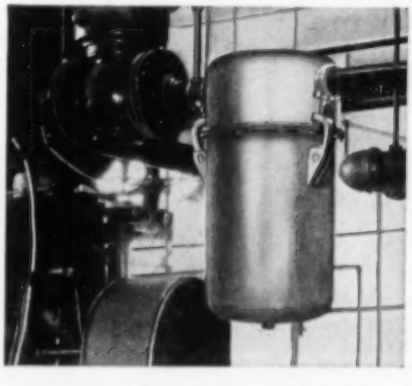
ELIMINATE VACUUM PUMP REPAIRS

USE STAYNEW VACUUM FILTERS





OPERATION — With filter installed between process and pump, dirty air enters at (A), striking baffle (B). Heavier particles of moisture and dirt are driven to the bottom of shell (C). Passage of smaller dirt particles is prevented by Radial Fin Insert (D). Clean, dry air *only* enters pump from (E).



A Staynew Vacuum Filter installed by a glass bottle manufacturer saved more than twice its cost every year. As a result, in a recent plant expansion, 10 additional Staynew Filters were placed in service to take advantage of these continuing savings.

COSTLY vacuum pump repairs, caused by intake of abrasive material, are unnecessary. Such repairs can be positively prevented at relatively low cost by the installation of Staynew Vacuum Filters.

Today, hundreds of these filters save time and money in the food, glass, ceramic, steel, chemical and other industries.

Featuring the original Staynew Radial Fin Construction, the high efficiency of Staynew Vacuum Filters makes them ideal for laboratory use.

Models available for both wet and dry process pumps. Special materials can be furnished on request.

COMPLETE INFORMATION ON REQUEST

IN CANADA: McCarthy and Robinson, Toronto Engineering Equipment Co., Montreal

DOLLINGER CORPORATION

FILTERS EXCLUSIVELY SINCE 1921

7 CENTRE PK., ROCHESTER 3, N.Y. • REPRESENTATIVES IN PRINCIPAL CITIES

DOLLINGER MFG. PROTECTOMOTOR U.S. PAT. OFF. STAYNEW FILTERS

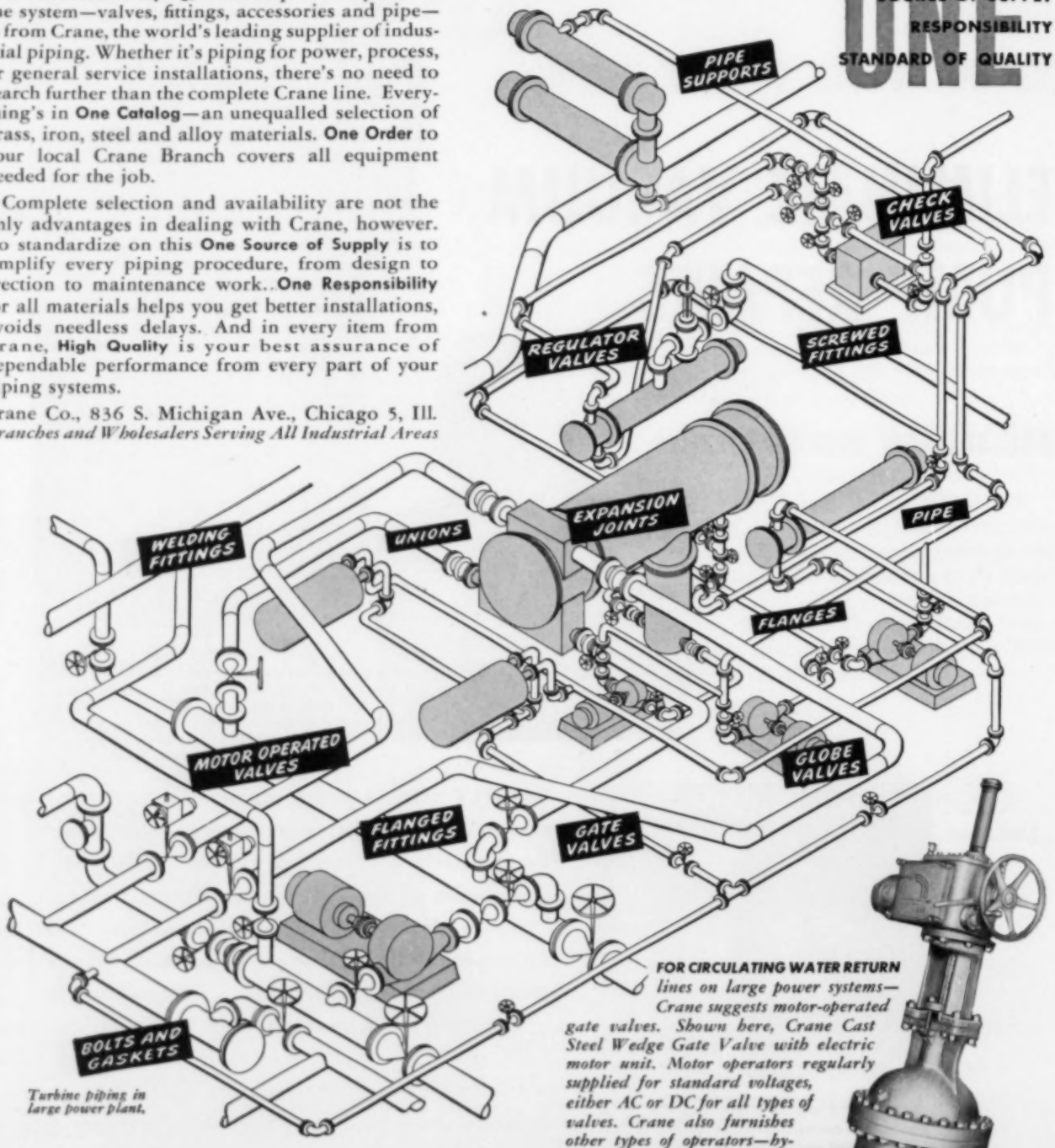
Everything in power piping ...on One Order to Crane

Take This Turbine Piping, for example. Every item in the system—valves, fittings, accessories and pipe—is from Crane, the world's leading supplier of industrial piping. Whether it's piping for power, process, or general service installations, there's no need to search further than the complete Crane line. Everything's in **One Catalog**—an unequalled selection of brass, iron, steel and alloy materials. **One Order** to your local Crane Branch covers all equipment needed for the job.

Complete selection and availability are not the only advantages in dealing with Crane, however. To standardize on this **One Source of Supply** is to simplify every piping procedure, from design to erection to maintenance work. **One Responsibility** for all materials helps you get better installations, avoids needless delays. And in every item from Crane, **High Quality** is your best assurance of dependable performance from every part of your piping systems.

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Turbine piping in large power plant.

FOR CIRCULATING WATER RETURN *lines on large power systems—Crane suggests motor-operated gate valves. Shown here, Crane Cast Steel Wedge Gate Valve with electric motor unit. Motor operators regularly supplied for standard voltages, either AC or DC for all types of valves. Crane also furnishes other types of operators—hydraulic, air, etc. See your Crane Catalog.*

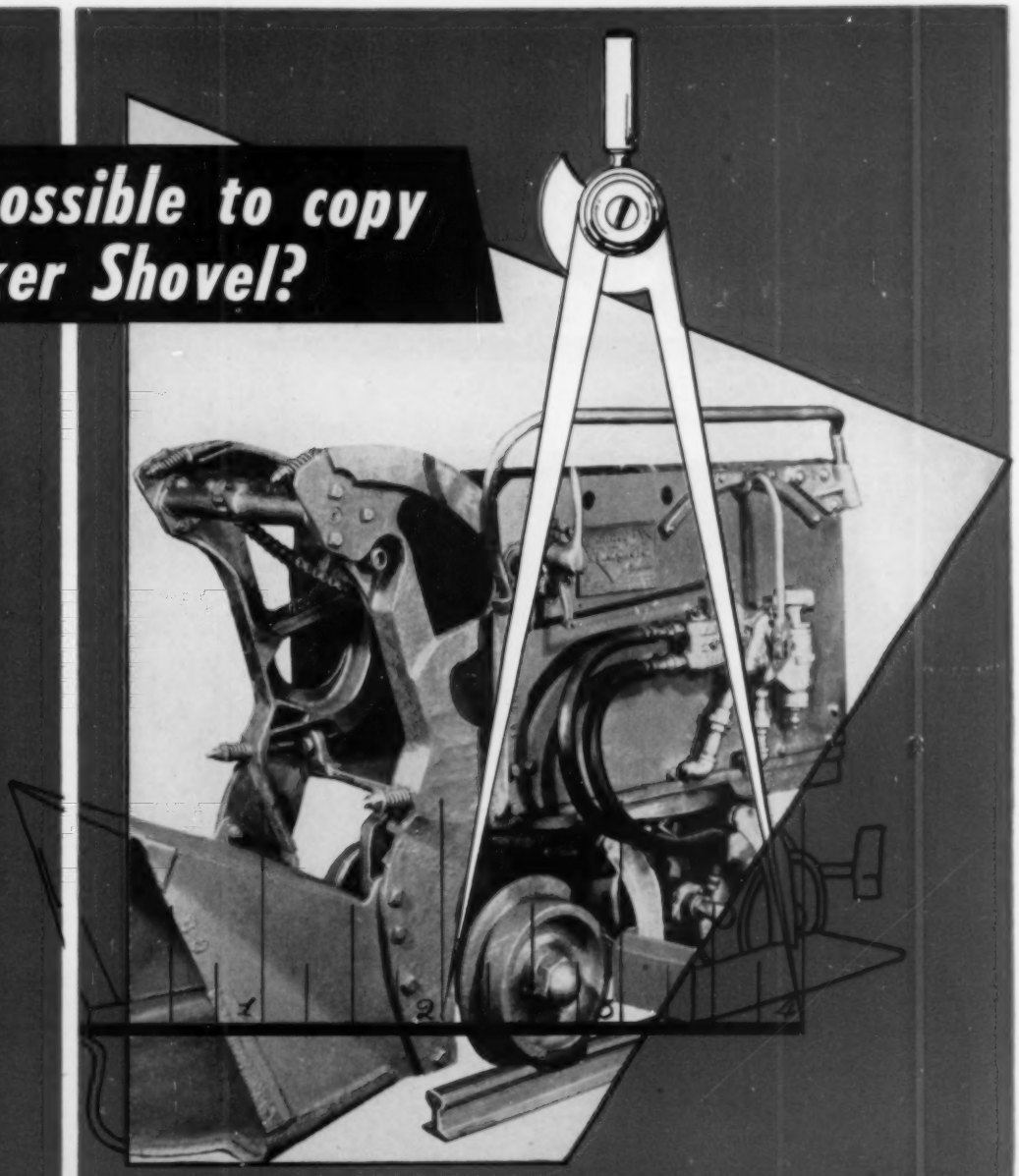
EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

Is it possible to copy a Rocker Shovel?



Yes! as far as outward appearance goes. In fact — it's been done. It's easy to design something that has already been designed, change it a little and call it your own.

The inevitable trap that catches all "followers" who would pick-up and take-off at the middle of the race is lack of experience.

Experience, at Eimco, dates back to the beginning AS WE ARE THE ORIGINATORS AND BUILDERS OF THE ONE ORIGINAL OVERHEAD TYPE OF LOADING MACHINE Many were the trials and errors before even machine No. 1 made its appearance in the world. We know why we build RockerShovels the way we do — many present day "would-be" contemporaries are still using features we threw away with the first experimental model.

Thousands of satisfied customers point to Eimco, (many after trying other makes) — they all say, "You can't beat an Eimco."

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.

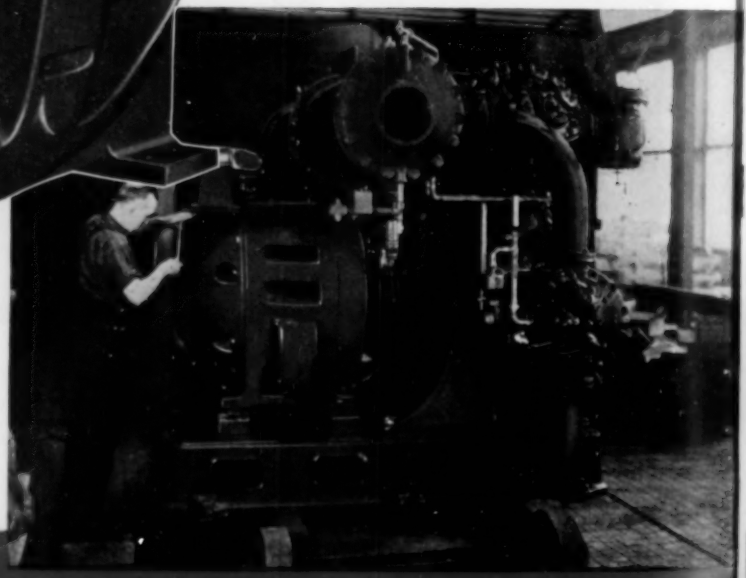
BRANCHES: NEW YORK, CHICAGO, BIRMINGHAM, EL PASO, SACRAMENTO, MANILA

AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

they're here... they're

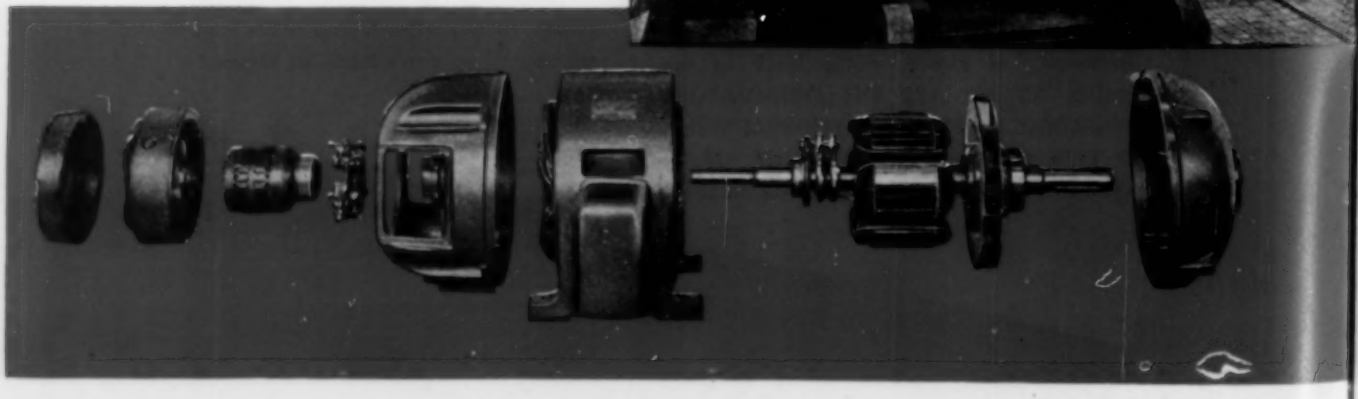
NEW G-E HIGH

A new TRI-CLAD Synchronous Motor typical of those machines rated at about 500 hp at 720 rpm.



A new TRI-CLAD High Speed Synchronous Motor, rated 250 hp at 600 rpm, direct coupled to an air compressor.

Exploded view of G-E TRI-CLAD machine.



TRI-CLAD

REG. U.S. PAT. OFF.

SPEED SYNCHRONOUS MOTORS AND GENERATORS

These new synchronous motors and generators bring you the famous TRI-CLAD improvements:

Extra Protection Features!—against physical damage—against electrical breakdown—against operating wear and tear.

New Styling!—smooth, rounded contours—baffled ventilating louvers—smooth-corners on exciters and conduit boxes.

Following General Electric design leadership, the new line of Tri-Clad synchronous motors and generators give you the same design features that made Tri-Clad motors so successful in more than a million and a half industrial applications.

Tri-Clad construction gives you protection where it counts. Frames and end shields with no openings above the center line—give protection against dripping liquids, falling objects, and accidental blows.

You get protection against electrical breakdown in normal operations. Proved insulating materials of the highest quality are used throughout. Small sizes (through frame 945) use Formex* wire for low voltage windings. Larger size coils are form wound and molded accurately to slot size.

Bearings are completely enclosed in cast iron with close running fits for long life with minimum maintenance. Deep oil reservoirs insure adequate lubrication with clean, cool oil.

You can get synchronous motors in the new Tri-Clad design in ratings from 20 hp to 1000 hp at 60 cycles, speeds from 514 to 1800 rpm. Synchronous generators are available from 12½ to 1250 kva. Direct connected exciters are available for any rating.

About ten years ago, the Tri-Clad design was introduced to combine the important features demanded by industry. Since then, it has been further improved with additional refinements—all of which have been incorporated in this new line of synchronous motors and generators.

For more information on how you will benefit from Tri-Clad construction in your synchronous motor and generator installations, contact your nearest G-E sales engineer. For detailed construction features, write for GEA-5113 (Motors) or GEA-5125 (Generators). *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

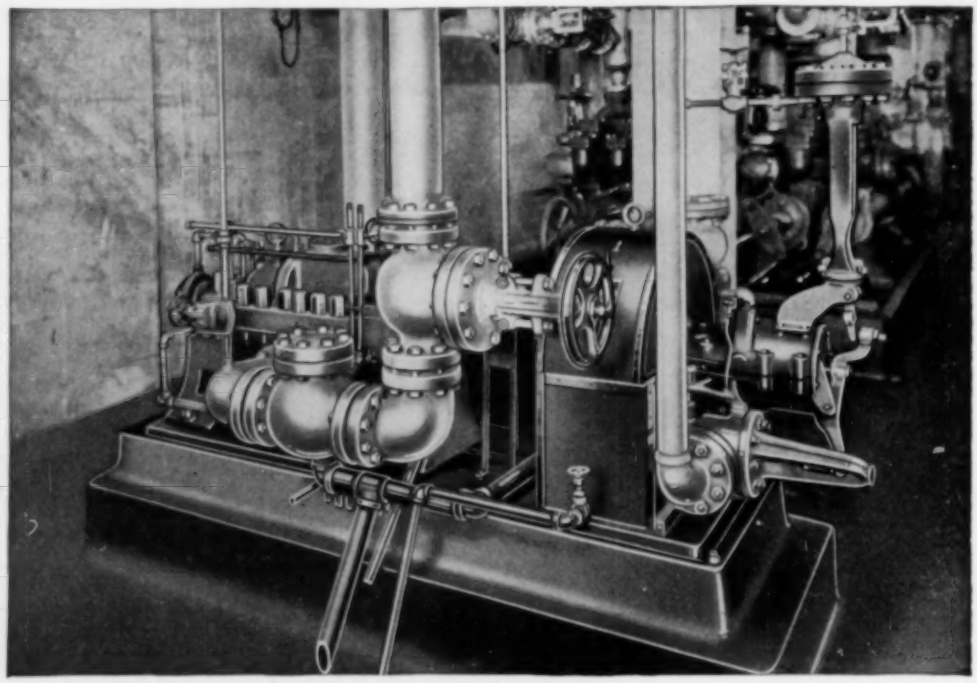
*Reg. U. S. Pat. Off.

Typical TRI-CLAD High Speed Generator with direct-connected exciter.

GENERAL ELECTRIC

770-1

TERRY



THE BLADES OF THIS BOILER FEED PUMP TURBINE ARE DOUBLE RIM PROTECTED

The 55 H.P. Turbine shown above employs the Terry Solid Wheel Rotor. The wheel is made from a single steel forging and the buckets are milled directly in the wheel.

The buckets are protected by rims at the sides of the wheel as shown in the illustration at the left. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearing are not required to obtain safe and dependable operation.

The Terry Wheel Turbine is fully described in our Bulletin S-116.

T-1170

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

How a NI-ROD build-up saved a 3-month lay-up

From Canada comes the story of how the cast iron main gear of a big power shovel, made in England, had stripped 74 of its 76 teeth.

Getting a new gear meant a delay of 3 to 4 months... and the shovel was urgently needed. So, the owners called the Bowers Machine Company of Canada to repair the present gear.

Welding seemed the only solution. But, cast iron welds were generally considered risky propositions. So, Bowers turned to G. D. Peters and Company, Ltd. for their opinion.

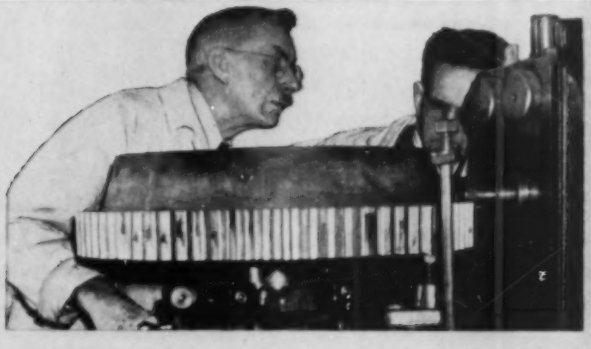
Yes, indeed, Peters' men reported, it was possible to build up this gear. But, it called for careful control... and a high quality Nickel-cored electrode called Ni-Rod.

See below the step-by-step picture story of how this unusual job was done.

1 After degreasing in carbon-tetrachloride, and a thorough cleaning, the damaged teeth were ground down to offer a smooth surface for welding. Where teeth were broken off flush, holes were drilled in the rim and tapped. Studs were then inserted to lend extra support to the new teeth.

2 Before welding, the heavy cast gear was suspended over a temporary oven and heated with an oil torch to 600° F. This eliminated stresses and the possibility of cracking. The welding electrode used was ⅛" Ni-Rod at 95 amperes. After making one pass on one tooth, the gear would be given a quarter turn to assure even distribution of the welding heat.

3 This photo shows finished Ni-Rod "build-ups" on 6 of the teeth. To cut down machining time, tooth-size formers were used to enable the welder to gauge the depth of his deposit. These formers were of brass because Ni-Rod does not fuse with that metal.



4 After the gear had gradually cooled overnight in a low coke fire, the work of milling and machining began. Above illustration shows teeth being milled into Ni-Rod deposits. This work, says Bowers, proved to be easier than expected because the Ni-Rod deposits machined perfectly. Thus, instead of a 3 or 4 month lay-up, the excavator was back on the job in less than 2 weeks.

*Reg. U. S. Pat. Off.

Ni-Rod comes in 3/32" to 3/16" diameters. Order a 5-lb. package and you'll agree it's the solution to any cast iron welding problem calling for strong, crack-free, machinable joints. *Write for free Ni-Rod instruction booklet.*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
INCO NI-ROD
TRADE-MARK

GET NI-ROD FROM:

Whitehead Metal Products Company, Inc.
Steel Sales Corp.
Williams and Company
Pacific Metals Company, Ltd.
J. M. Tull Metal & Supply Co.
Eagle Metals Co.
Metal Goods Corporation
Robert W. Bartram, Ltd.
Alloy Metal Sales, Ltd.
Wilkinson Company, Ltd.
Metal & Thermit Corporation
Hollup Corporation
National Cylinder Gas Company

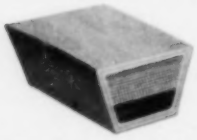
Fills Every Need for V-Belt Drives!

TEXDRIVE SHEAVES
Cast Iron with 1 to 6 grooves for A and B belts. 1 to 25 h. p. *All sizes from stock.*

VARI-PITCH WIDE RANGE SHEAVES
Speed range up to 100%. 1 to 4 grooves, Q and R belts, fractional to 30 horsepower. Delivery good. *Call your nearest District Office or Texrope dealer.*

TEXSTEEL SHEAVES
Welded pressed steel with rolled edges. 1 to 6 grooves, A or B belts, ¼ to 25 horsepower. *All sizes from stock.*

STANDARD CAST IRON SHEAVES
Made to order from stock patterns. 1 to 14 grooves, A, B, C, D, or E belts, 1 to 1000 horsepower. Delivery good. *Call your nearest District Office or Texrope dealer.*



TEXROPE SUPER-7 V-BELTS
Wide range of types, sizes and sections to suit all operating conditions. *All standard sizes from stock.*

MAGIC-GRIP SHEAVES
Semi-steel with patented taper bushing. On and off in a jiffy. 2 to 12 grooves, B, C, or D belts, 2 to 250 horsepower. *All sizes from stock.*

SPECIAL CAST IRON AND STEEL SHEAVES
Any number of grooves for A, B, C, D, or E belts. Up to 6000 horsepower. Delivery good. *Call your nearest District Office or Texrope dealer.*

TEX-IRON SHEAVES
Light weight single groove sheave for fractional horsepower applications. *All sizes from stock.*

VARI-PITCH STANDARD SHEAVES
Speed range 9% to 28%. 2 to 10 grooves, A, B, C, D, or E belts, 1 to 300 horsepower. Stationary or Motion Control. Delivery good. *Call your nearest District Office or Texrope dealer.*

VARI-PITCH SPEED CHANGERS
Speed range to 375%. 1½ to 75 horsepower. Single handwheel controls speed. Delivery good. *Call your nearest District Office or Texrope dealer.*

Best Delivery in the Industry!

NOW YOU CAN GET nearly every standard V-belt drive component from Texrope stocks. Even on non-stock items, Texrope delivery is the best in the industry. And Texrope is the *only* brand that meets *every* V-belt need.

Selecting a drive is as easy as looking up a telephone number in the 144 page Texrope Pre-Engineered Drive book. Covers 90% of all V-belt drives. Write today for Bulletin 20 B 6956 or see your nearest Allis-Chalmers Authorized Dealer or District Office. Also listed in Sweet's.

ALLIS-CHALMERS, 1000A SO. 70 ST. A 2546
MILWAUKEE, WIS.

Texrope, Super-7, Vari-Pitch, Magic-Grip, Tex-Iron, Tex-steel and Texdrive are Allis-Chalmers Trademarks.

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

He knows good drill steel

He works with drill steel every day in this shop at a large metal mine. He knows practical heat-treating and forging practice. He's sold on Bethlehem Hollow Drill Steel because he knows this fine steel meets every requirement—both in his shop and in hard rock drilling.

Bethlehem Hollow has a wide quenching range. It makes tough shanks, hard bits, and long-wearing threads. It forges readily to close dimensions. The center hole is smooth and true. It stays on the job longer because it is tough, fatigue-resisting . . . and it's fine for either forged-on bits or detachables.

Order it by name from your nearest supplier or our mill. You can get prompt delivery of standard sizes. You'll agree there's no better steel for economical, dependable performance.

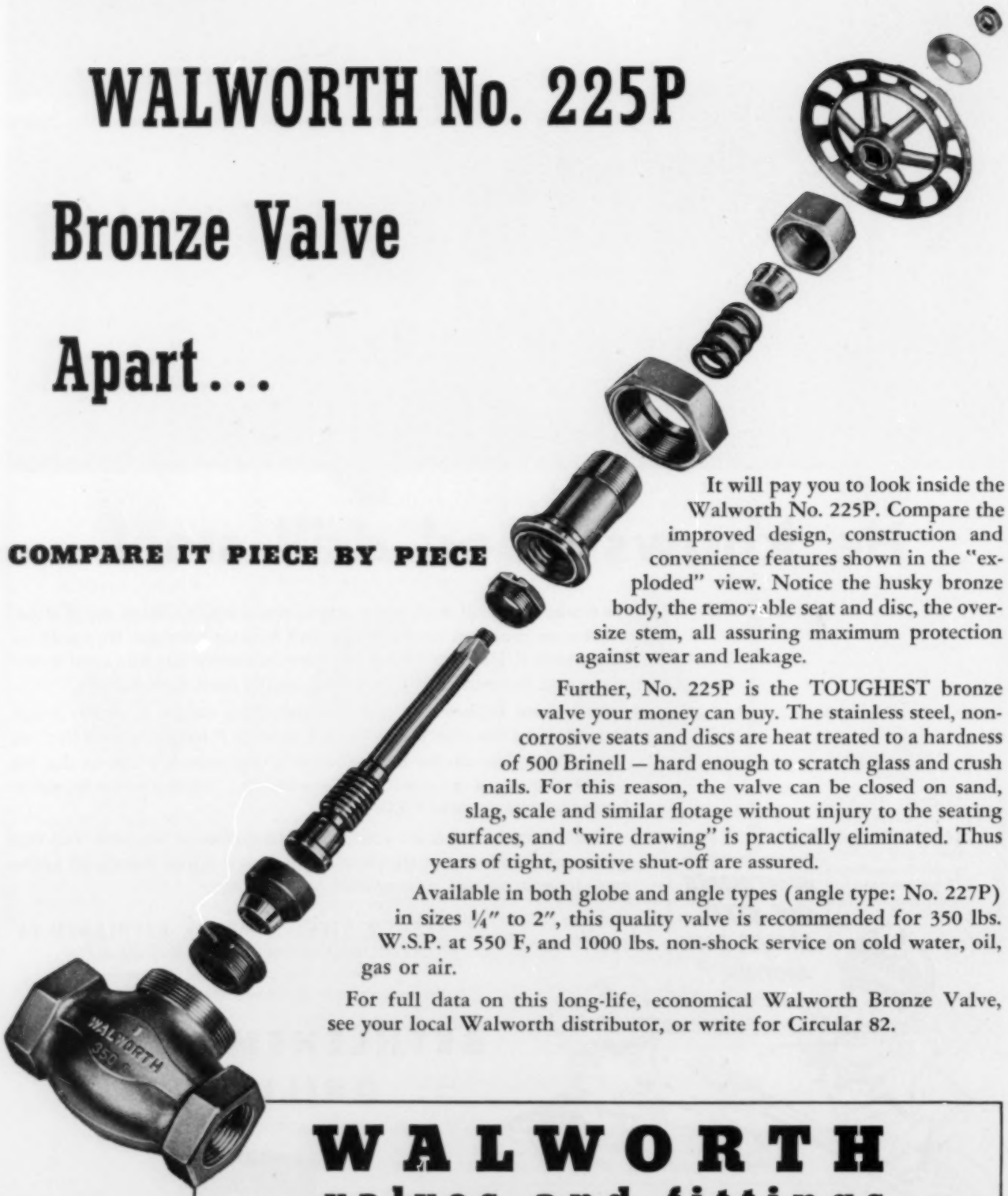
BETHLEHEM STEEL COMPANY, BETHLEHEM PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL

★ BETHLEHEM STEEL ★

Take a WALWORTH No. 225P Bronze Valve Apart...



COMPARE IT PIECE BY PIECE

It will pay you to look inside the Walworth No. 225P. Compare the improved design, construction and convenience features shown in the "exploded" view. Notice the husky bronze body, the removable seat and disc, the oversize stem, all assuring maximum protection against wear and leakage.

Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas or air.

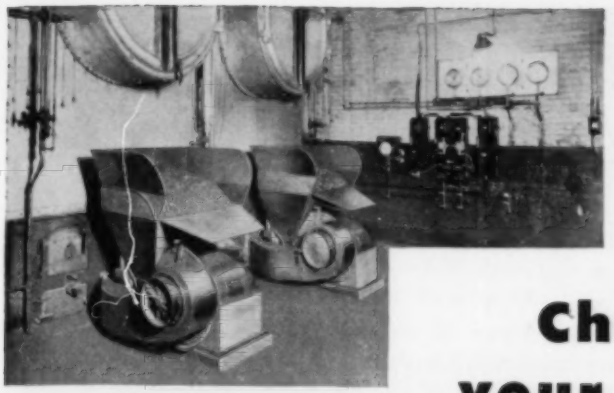
For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular 82.

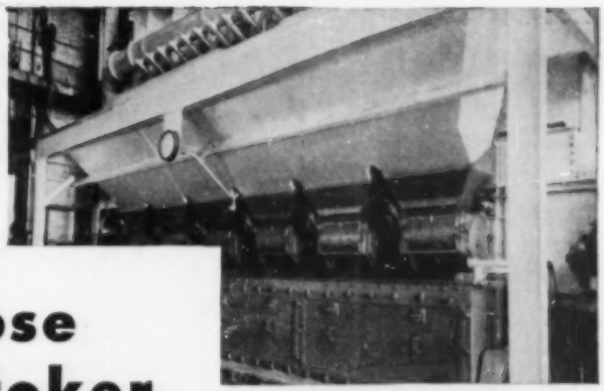
WALWORTH

valves and fittings

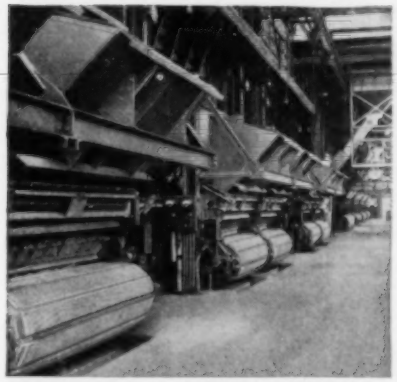
60 EAST 42nd STREET, NEW YORK 17, N. Y.

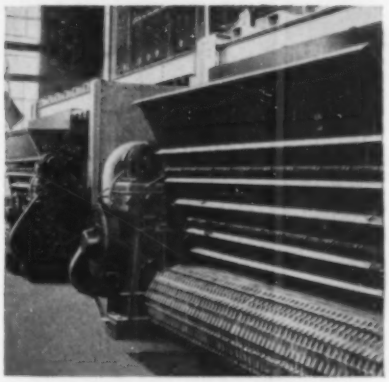
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD





Choose your stoker for the YEARS AHEAD



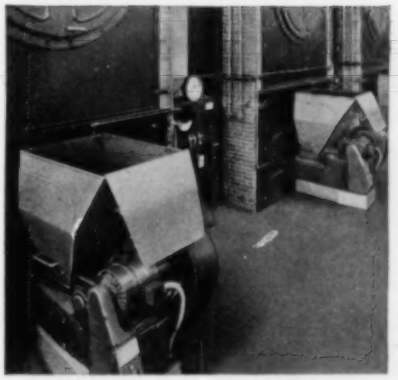


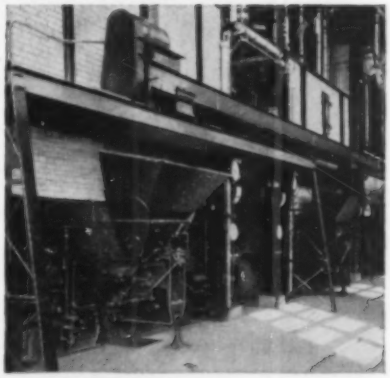
The price you pay for a stoker is only a down payment on the continuing cost incident to steam generation. For example, the cost of fuel burned each and every year throughout the useful life of the equipment far outweighs the original purchase price of the stoker. And, at today's coal prices this fact is of paramount importance to you.

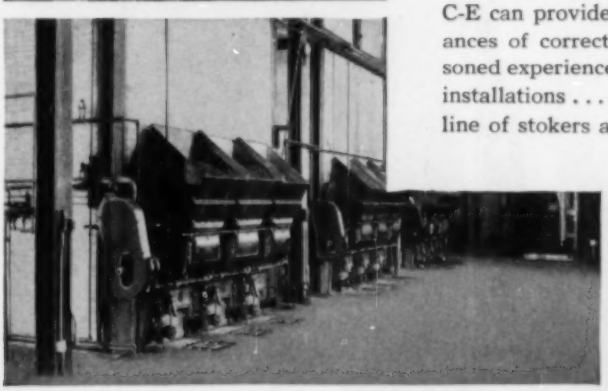
Furthermore, there is no "general purpose" stoker. Each basic type has advantages that are realized fully only when matched with coals of definite characteristics under well-defined operating conditions. How essential it is, then, that you make the correct selection . . . that you avoid the pyramiding costs that inevitably result from improperly selected equipment.

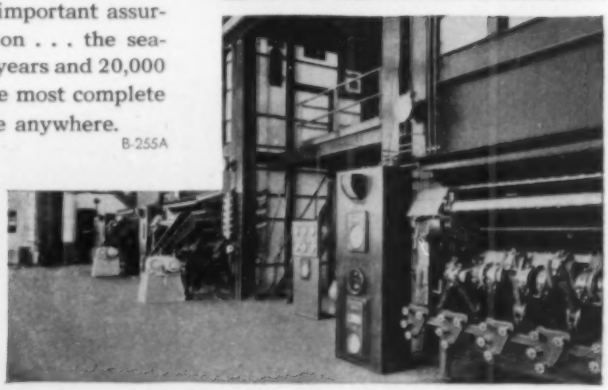
Turn to C-E with confidence, for only C-E can provide these important assurances of correct selection . . . the seasoned experience of 64 years and 20,000 installations . . . plus the most complete line of stokers available anywhere.

B-255A







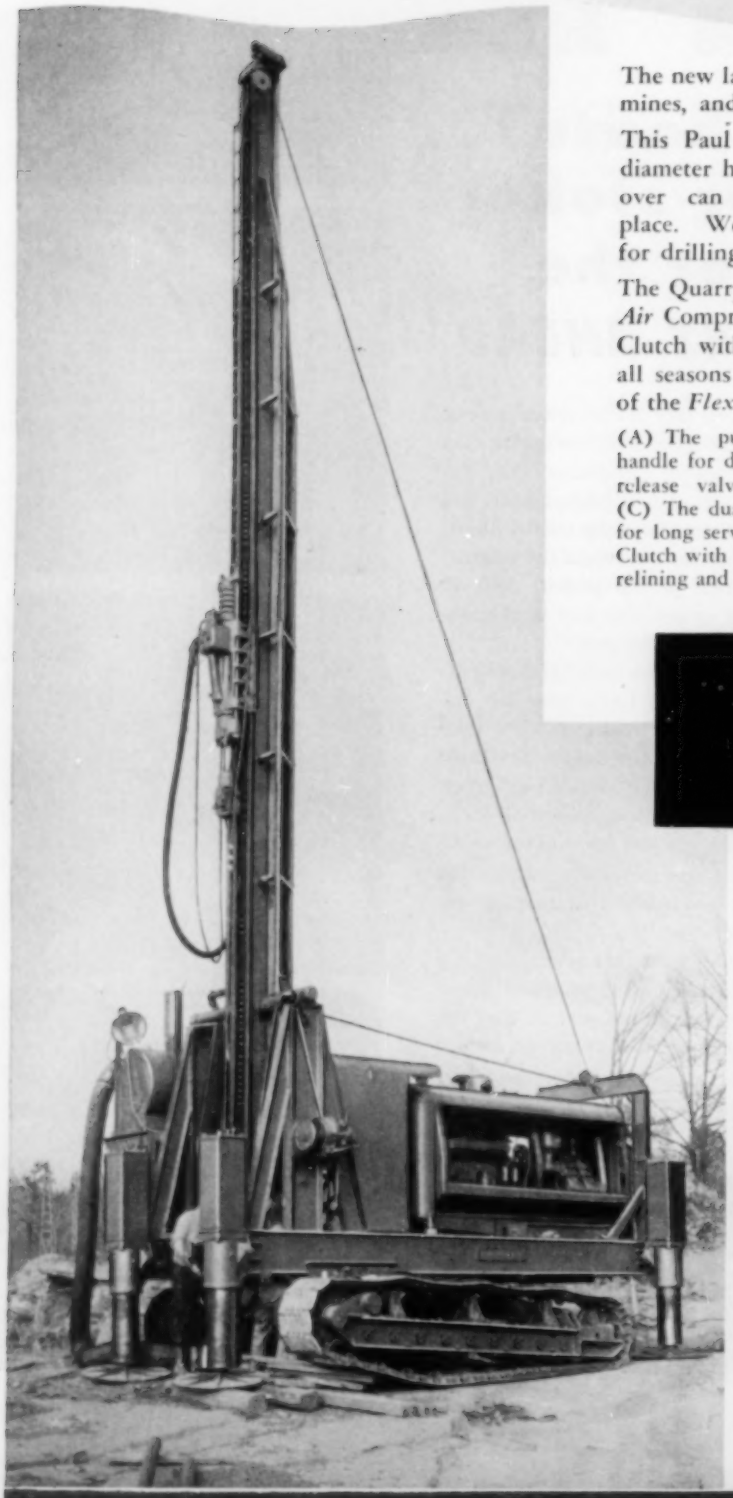


COMBUSTION ENGINEERING

200 MADISON AVENUE · NEW YORK 16, N. Y.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

NEW QUARRYMASTER HAS FLEX-DISC CLUTCH WITH HYDRO-SHIFTER



The new landmark of development work in the quarries, mines, and coalfields of 1948 is I-R's *Quarrymaster*.

This Paul Bunyan of rock drills takes on the large diameter holes which it drills fast and deep, and moreover can move under its own power from place to place. We show it here with tower erect in position for drilling in a Pennsylvania crushed rock quarry.

The Quarrymaster is equipped with the KA 500 *Mobil-Air* Compressor connected to the engine by a *Flex-Disc* Clutch with *Hydro-Shifter* for easy clutch operation in all seasons and at all altitudes. The principal features of the *Flex-Disc* Clutch with *Hydro-Shifter* (below) are:

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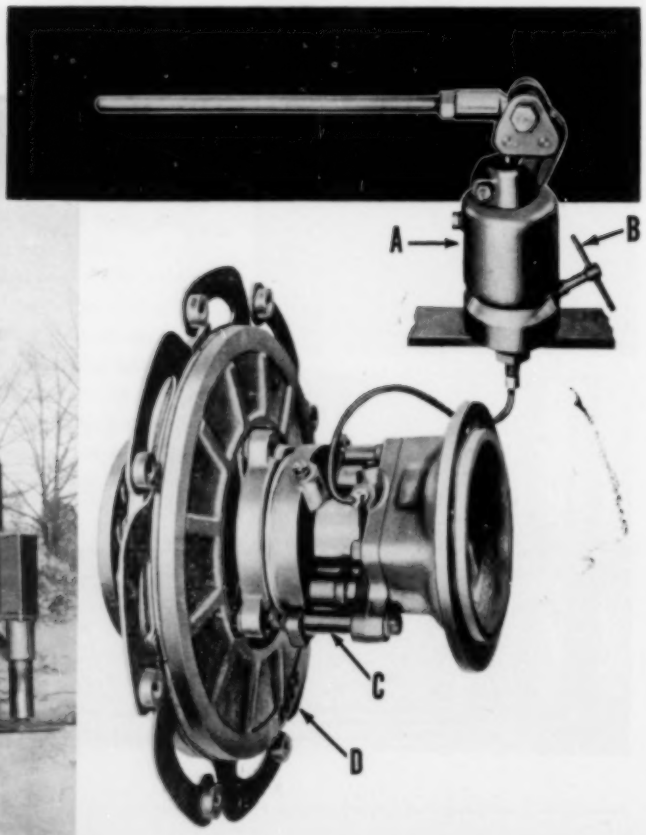

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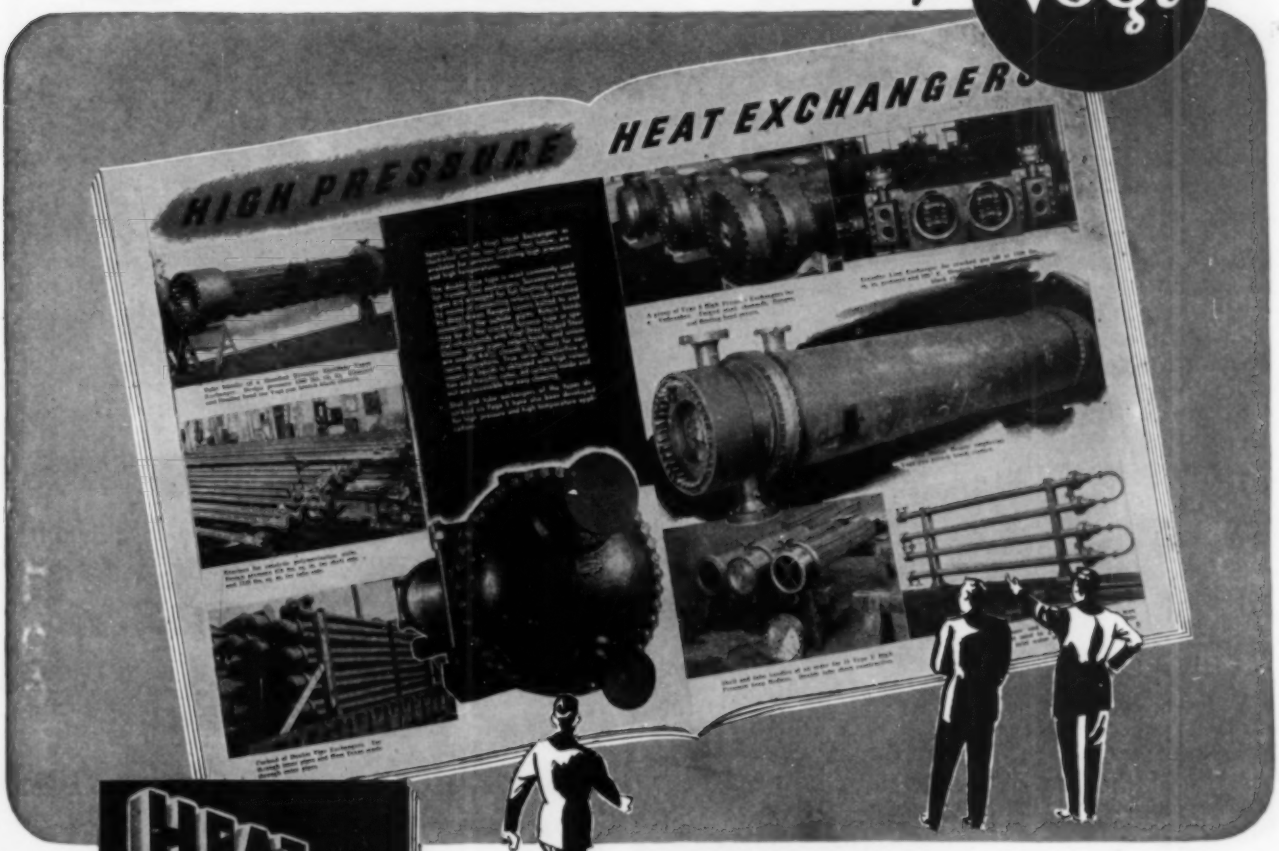

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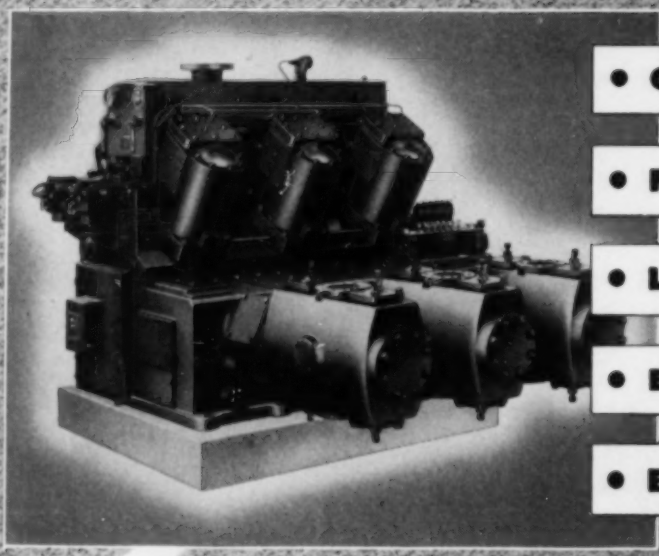

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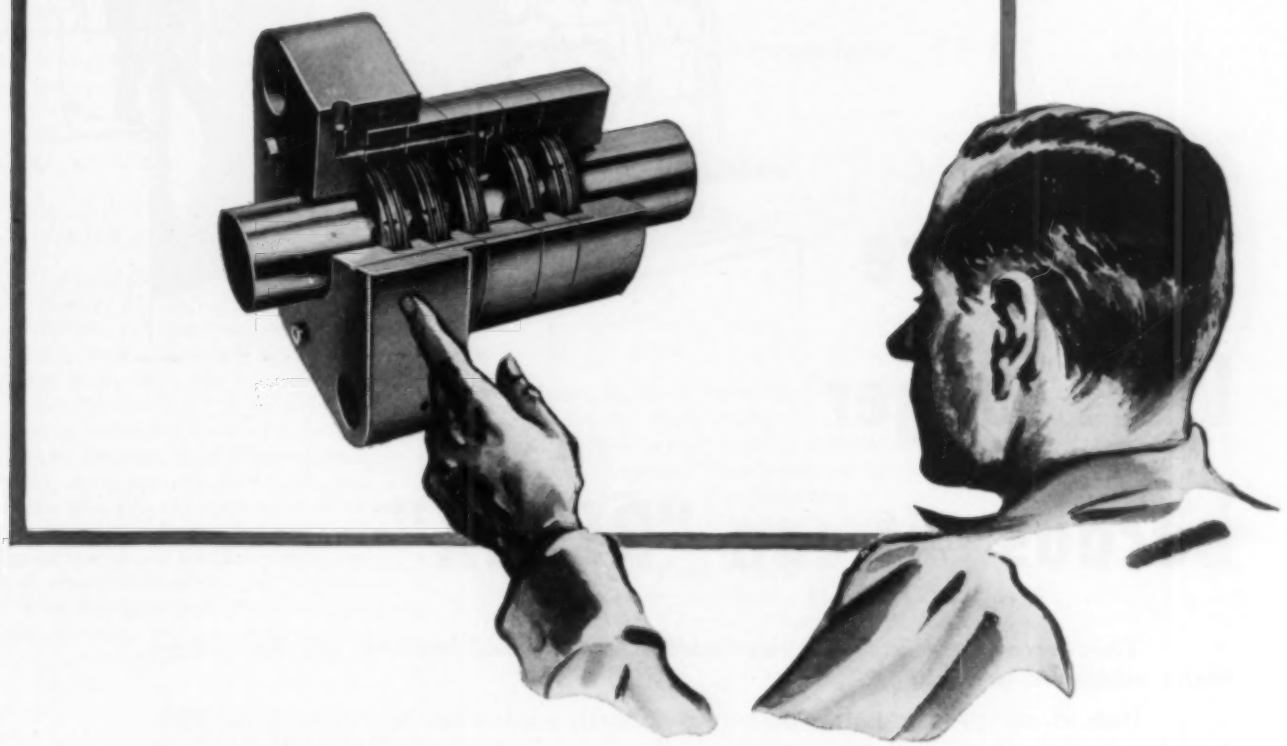

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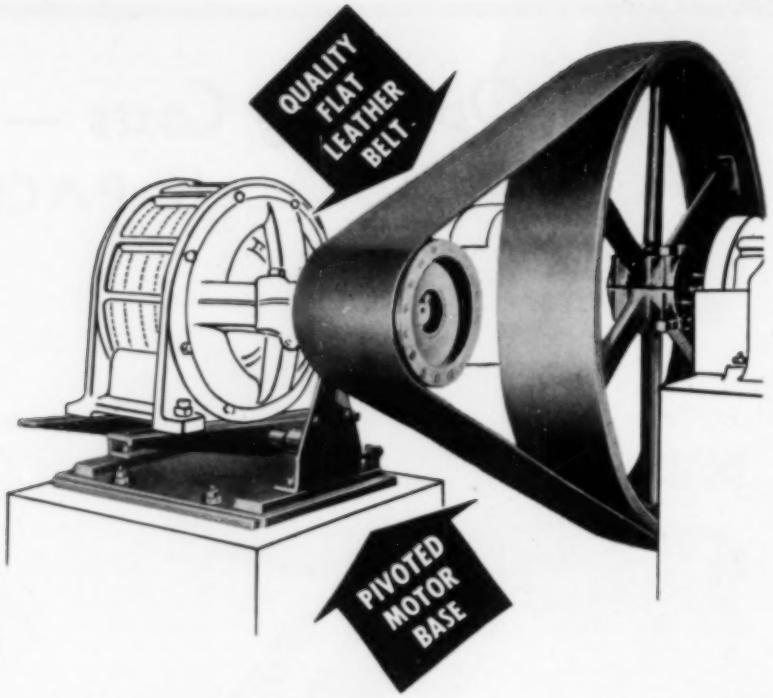


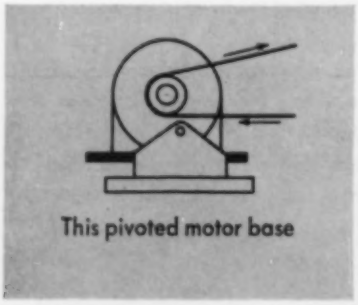
This drive lasts longer because it can "RELAX"

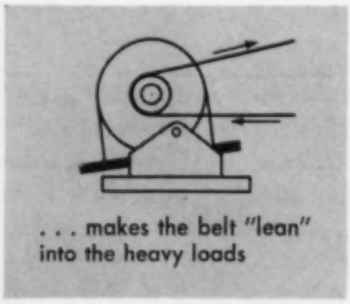
This drive gives longer service because the belt and bearings are not always under maximum tension.

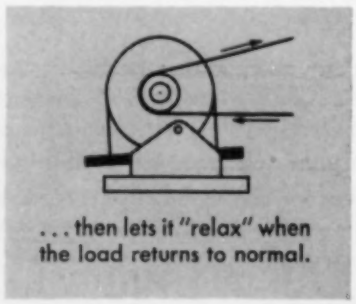
Instead, the pivoted motor base automatically adjusts belt tension to fit the load. It makes the belt "lean" into the heavy loads, then lets it "take it easy" when the load gets back to normal.

The quality leather belt makes the drive's job easier by providing a long-lived pulley grip. This helps the belt carry both heavy and light loads with less tension. The natural self-adjusting resiliency of the belt cushions shock, saves wear.

Together, the leather belt and the pivoted base drive the compressor with minimum strain.


This pivoted motor base


. . . makes the belt "lean" into the heavy loads


. . . then lets it "relax" when the load returns to normal.

American LEATHER BELTING *Association*

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ON THE COVER

THREE seasons ago, when orchard labor was getting scarcer and more expensive, Dave Wheatley, a prune grower near Napa, Calif., went into his farm shop and built the pruning tower illustrated on the front cover. It is self-propelled by a 5-hp. gasoline engine, which also drives a compressor to supply air power for operating pruning shears. Orchard hands who formerly trimmed trees while perched precariously on ladders, naturally took kindly to the innovation, which enables them to do more work than formerly with less fatigue and in complete safety.

•

SHERMAN HILL TREE

FROM the Executive Editor of *Construction Methods*, H. W. Richardson, comes the information that we missed a human-interest story in connection with the pine tree shown on Page 252 of our October issue with the article on *Producing Ballast for the Union Pacific at Sherman Hill*. Western rearing plus a quarter-century of following major construction jobs the country over, have given Mr. Richardson a thorough knowledge of the Union Pacific system, and a lot of other railroads as well. He writes:

"This tree (pictured below) is famous throughout the West because the original Union Pacific line ran very close to it. The story goes that a tree-loving fireman took pity on a struggling shoot growing out of a big rock along the right-of-way and every time his locomotive passed the spot he would toss a bucket of water on the tree to give it a good start in life. Some years ago, on a realignment job, the tracks were moved a considerable distance away from the tree, but the highway now passes close by it. The tree is protected by a fence and there is a metal plate attached giving this interesting story."

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Air Power—the New Farm Hand

Man with the Hoe Gets a Lift After Ages of Drudgery and Tree Jobs Come Down Off the Ladder for Safety

F. Hal Higgins

PNEUMATIC HOES

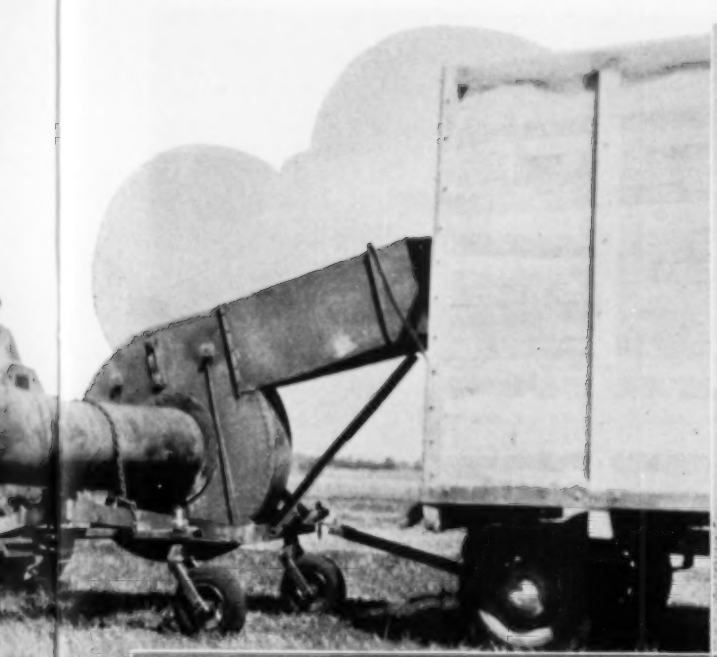
To speed up the hoeing of his sugar beets and to eliminate the back-breaking labor that has heretofore attended this operation, Frank E. King devised this machine. The tool is of the sand-rammer type, with blades on the lower end of the piston rod that shuttles back and forth many times a minute. The men only have to guide them along the rows. The boom attachment for the air hoses is patterned after the arrangement used by railroad crews for track and ballast work. A portable compressor towed by a tractor furnishes the air power.

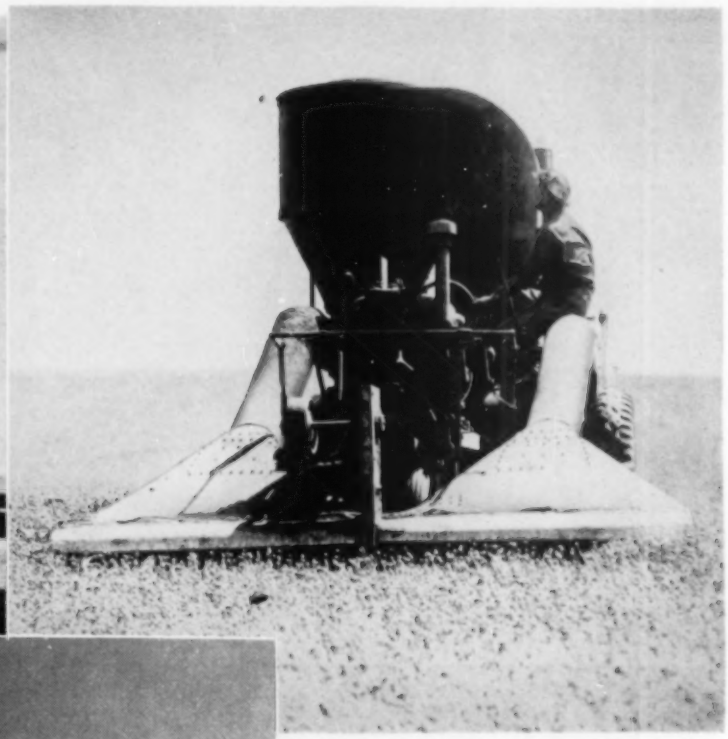
COMPRESSED air is the new farm hand in California. Out on the West Coast big things are happening in the mechanization of farm jobs heretofore thought anchored through time to hand labor. The Golden State has been a mechanized farming area since the gold-rush days, when men in a hurry to make their fortunes flocked there from all nations and sections of the United States in search of the yellow metal. Workers were scarce, high priced, and truculent on the job. Hence, every field of endeavor began to equip labor with bigger and better machines and tools than it had ever used.

Freighting, mining, logging, farming, and transportation all felt the impact of this scramble for quick riches by eager young men with gold in their pockets demanding tools that would do more and faster work. From the outset of the gold-hunter invasion, California blacksmiths, wheelwrights, mechanics, and foundrymen had the incentive to build daringly for prospectors who knew what they

FIRST FARM AIR POWER

Typifying California's original use of air power is this windmill that is harnessed to provide water at seven outlets around a ranch. The windmill has served American farms since colonial times and is still a prominent feature of the landscape in many states. In California, however, it has been largely supplanted by the internal-combustion engine.





VACUUM SEED HARVESTERS

A few years ago, Wyatt & Dunne, father-and-son-in-law farmers near Oakdale, Calif., discovered that much valuable Ladino clover seed was left on the ground by prevailing harvesting practices. They rigged up the vacuum sweeper shown at the top-right and became the biggest and most prosperous Ladino seed growers in the state. George Fiack, living in another section of the state, put the same idea to work in 1944, fashioning the apparatus pictured just above after examining his wife's vacuum cleaner. With his machine, Fiack recovered $30,000 worth of seed from stubble remaining in his neighbors' fields after harvesting with equipment then available. Fiack proved that as much as $150 per acre was being lost, and other farmers were quick to devise their own "sucker-uppers," as they dubbed them. The 30 or 40 now in service follow no uniform pattern, but all embody the vacuum principle. The one illustrated at the top-left has a blower that shoots the vacuumed seed, dirt, and trash into the trailer for transportation to a cleaning station.

wanted and were willing to pay without quibbling over price. As a result, there has come out of this area during the past century leadership in many mechanical fields—pumps, tractors, and heavy-duty motor trucks, as well as dirt-moving, logging, irrigation, and reclamation equipment.

The present postwar era in the West has given an impetus to this trend, with California's agriculture taking the initiative in providing machines for cutting costs and improving the quality of fruits, vegetables, nuts, soil-building seed crops, etc. Looking back over the state's century of progress in mechanization for one purpose or another, it is interesting to observe the increasing use of compressed air on its farms. Of course, air power of Nature's making goes back to the start of California agriculture and was used for turning wind mills long before internal-combustion engines came into the picture.

The new air-powered farm implements may be divided into two classes: those that are operated by compressed air, and vacuum equipment or "sucker-uppers." Included among them are shears, knockers, saws, hoes, and scythes; tools in ranch shops for maintenance and repair; pneumatic bomber tires used in floating big combines and to bank out rigs in wet fields; and vacuum harvesters for seeds, nuts, alfalfa, and other hay crops.

In the past two decades there has been a marked rise throughout the United States in the growing of soil-building crops such as legumes, including all the clovers. Wasting of the top soil through erosion and the high cost of commercial fertilizers have combined to bring to a focus the importance of these nitrogen-gathering plants. Therefore, wherever they could be raised for seed, these legumes have become valuable cash crops for the producers. Ranking high among the clovers is one from Italy known as Ladino, a droopy headed white variety with small light seeds that shatter and drop readily to the ground. Until about ten years ago, none of the available harvesting machines or methods could save more than a comparatively small percent of this new and valuable crop, yet the seed was worth well over $1.50 a pound and kept edging higher until the farmer was receiving $2.25 a pound for No. 1.

At that time, Wyatt & Dunne, a

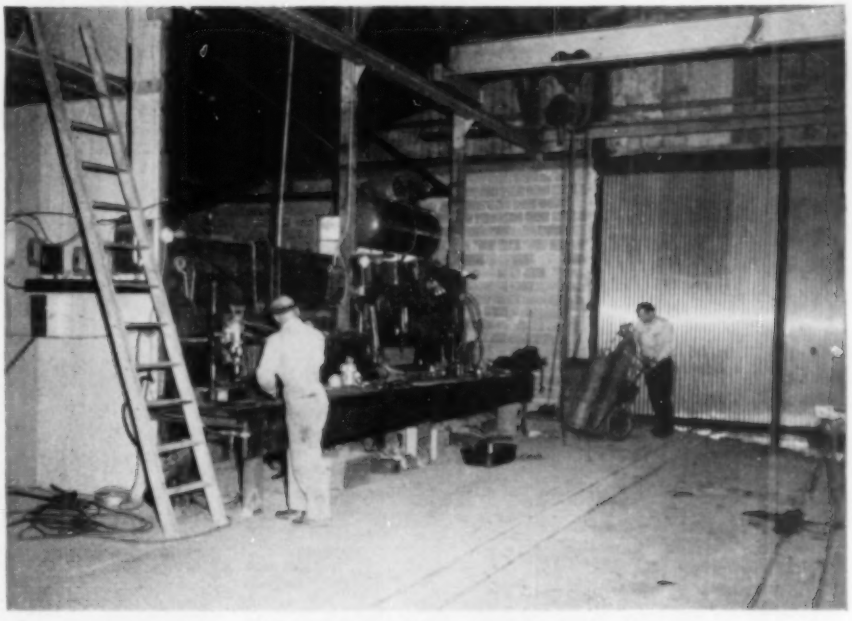
MISCELLANEOUS PNEUMATIC FARM AIDS

1– The third almond harvester built by F. E. Keaton in his farm machine shop. After the nuts are knocked off the trees with rubber mallets, they are picked up by a vacuum attachment, conveyed to the rear of the equipment, cleaned of trash, and bagged. 2– Dave Wheatley, Napa Valley prune grower, created this duster to control tree insect pests. A fan mounted on the front of an old Packard car furnishes the air blast that blows chemicals into the foliage for complete coverage. 3– A compressor and storage tank mounted on a tractor supply compressed air with which oil is sprayed on sweet-corn silk by men who walk behind the machine. They treat the silken tip of each ear to kill worms before they can bore into the corn. 4– This outfit, shown in a field near Davis, Calif., is a "Sizz-weeder" that is used to burn small weeds before tomato plants come up. Compressed air spreads the flames for wide coverage.

father-and-son-in-law team near Oakdale, Calif., rigged up their Farmall tractor with a pair of vacuum sweeps to harvest their crop. They managed to get a patent or two on the thing to keep the idea bottled up so that others might not be tempted to go into the Ladino-seed business. That was before the war, and the machine has helped to make Wyatt & Dunne the biggest growers of seed in the state. By their system of pasturing sheep and harvesting the seed for sale on a rising market they make a double profit from their clover.

In Glenn County, California, lived an ingenious farmer, George Fiack, who had started to raise Ladino seed on his small holdings along the west side of the lazy Sacramento Valley. It was in this area that Doctor Glenn, for whom the county was named, had become the world's biggest wheat grower in the 70's and 80's when he cultivated some 66,000 acres in a solid block. Fiack looked at his wife's vacuum sweeper, and then went out and bought a blower and reversed it to suck instead of blow. He attached it by means of a 6-foot sweep to the back of his TD-9 crawler tractor and tried it out on his Ladino stubble after he had harvested the seed, knowing there was a lot he had not been able to garner by the usual method.

The results startled Fiack. He immediately went to his neighbors and asked permission to "clean" their stubble. "I'll take 50 percent for myself and machine and give you the other half of whatever I recover," he promised. It was like a gold mine, and in three weeks he divided about $30,000 with his neighbors. Then they took the hint and each built his own "sucker-upper," as they termed the vacuum harvester, or ordered a local machine and welding shop to construct one according to his plans.



FARM MACHINE SHOP

Many large California farms have machine shops, some of which cost up to $25,000. The one pictured is on the Switzer Ranch near Stratford and set its owner back around $12,000. Overhead, near the center, may be seen an air compressor and receiver for powering various tools, inflating tires on farm equipment, operating paint-spray outfits, etc.

PNEUMATIC TREE PRUNER

Frank E. King, California farmer who developed the mechanical hoeing machine illustrated on Page 262, is shown holding the air-cylinder end of a pruning shears he built in his shop as an improvement on a tool used by a neighbor. In addition to turning out shears in three lengths, he has adapted the tool for shaking walnuts and almonds off trees at harvest time and has also devised an air-driven saw for pruning limbs that are too large for shears.

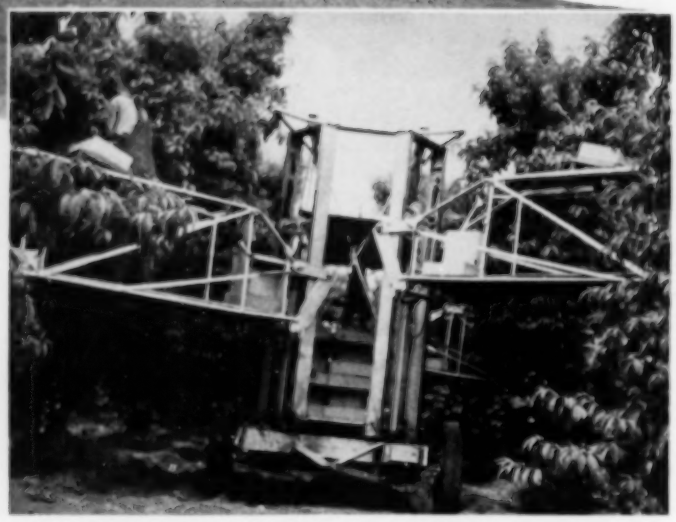
No two were alike, and there was a lot of changing of engines, fans, speeds, etc., the first season or two as owners, operators, and shopmen learned by experience. Some fields were yielding as high as 300 pounds of No. 1 Ladino the second year a crop was grown and harvested. A conservative estimate would put the number of these vacuum harvesters in California's Sacramento Valley at 30 or 40, while added income to the farmers has mounted into the millions of dollars. Glenn County now has a seed growers' association and ships its certified Ladino all over the map. Texas took a lot of it for the first time last winter, and some went abroad.

That ladder labor is slated to come down off its high and dangerous perch is a surety because of the introduction of towers carrying air-powered pruning shears and other devices designed to do the tree jobs. The first of these units in California appeared about three years ago in the Santa Clara Valley of prune fame. It was pulled by a horse, and mounted on the lower platform was a small gasoline engine-driven compressor and air receiver adequate to service two long-handled pruning shears with which tree branches were snipped off with safety, one man standing on the ground and the other working on a platform 8 feet above the lower deck.

Over in the Napa Valley, nearly 100 miles to the north, was another such machine with one little gas engine doing double duty; that is, moving the tower and driving the air compressor that powered the shears. This outfit worked so well that the orchardist built a second one for pruning bigger trees. These owner-inventors have rounded out three years of experience with their towers and pneumatic equipment, which they have found so satisfactory that the idea is spreading up and down the state.

But the grand champ of all these tree machines is the one that appeared in crude form in Kern County in 1947. Merrill Orchards, peach growers for some 30 years, designed it for their own use. They called it Multiplatform Fruit-tree Machine, but the writer immediately dubbed it Iron Monkey when he saw it with its crew of four picking a crop early in June about 4 miles south of Shafter. This year the tower will be busy pruning, thinning, and harvesting for about 160 days at three orchards. Tree labor likes it and takes pride in using it. The peaches are picked without danger of bruising and at the best time for market topping. Workers are paid by the hour intead of by the box and are not endangered by falls off ladders. It takes fewer men to do the harvesting, and they stay the year 'round instead of moving from one orchard to another.

University of California agricultural



LADDER ELIMINATORS

Much orchard work has traditionally been done from ladders—a slow, laborious, and dangerous method. With farm hands commanding $1 and upward an hour and growing more reluctant to climb, various types of portable, maneuverable-platform machines are making their appearance. Some, such as the one shown at the top-right, are exclusively for pruning. Others are adapted for all kinds of orchard jobs, including harvesting. Pictured at the lower-right during peach-picking time is the Iron Monkey developed by Merrill Orchards. It has four catwalks on each of which one or two men can operate. Lifts raise or lower the platforms, and they can be swung right or left to reach every peach. Lights permit working at night, if necessary. The machine will be busy 160 days this year and has displaced ladders on this farm. The Boone telescopic date tower, left, is the answer to date growers' demands for a portable unit that can be readily moved and adjusted. Normal operations—pruning, artificial pollination, dethorning, bagging, and several pickings—formerly required climbing these big trees 15 to 25 times a season. Now all the work is done quicker, safer, and easier from this tower, which was built in a ranch shop near Hayward, Calif. Only two units of this type have so far been put in service.

engineers who have journeyed down to the Merrill Ranch to study the possibilities of the machine believe it to be the answer to the tree-fruit grower's efforts to cut costs. While no production plans are in sight as the tower finishes its second season, it helped to harvest citrus fruits in Southern California last winter, and everything is set to try it in pear, apple, cherry, and other orchards. At present it is hauled around by truck, but before the next crop is ready for picking it will be equipped to run under its own power. A small gasoline engine beneath the lower platform operates the compressor that supplies the air for the pruning shears.

The compressor, by the way, is practically standard equipment in California ranch shops and powers various air-operated tools and devices such as are found in modern maintenance shops. The writer has noted several that have set their owners back $12,000 to $25,000 each and that are complete with lathes, grinders, drill stands, portable and stationary welding outfits for inside and outside work, steam cleaners, saws, etc., for doing any metal job that may come up on a farm. Some of them are equipped to build combines and any machine that is not on the market and may be needed to meet special crop or soil conditions.

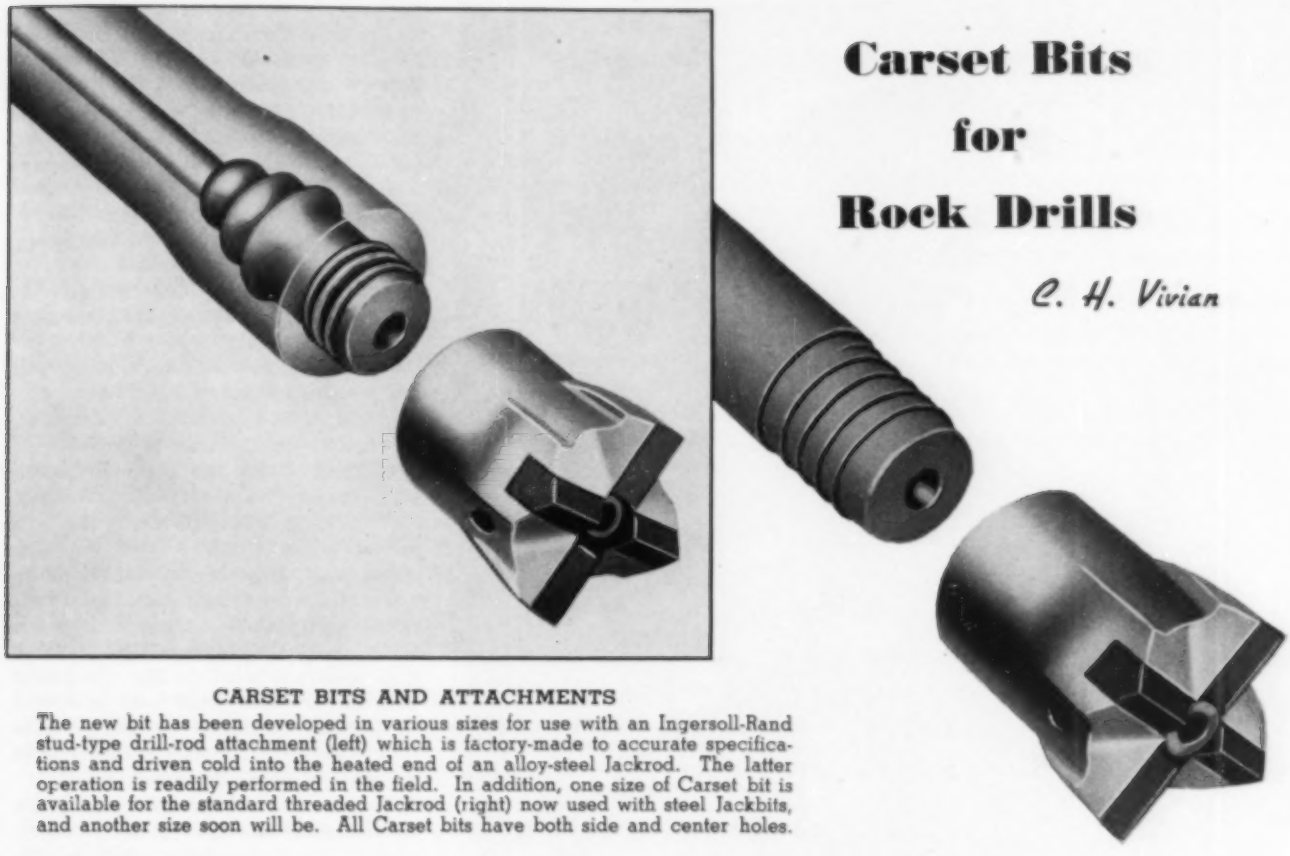
The most revolutionary of the new air tools to appear in California this year to supplement the farmer's electric high line, tractor, motor truck, and machinery generally is a hoe that was developed by Frank E. King, a sugar-beet grower. It is an interesting example of the trend towards mechanization or air power on the farm and caught the fancy of members of the American Society of Agricultural Engineers when seen by them in colored movies at their annual convention on the West Coast last June. The film was shot by University of California agricultural engineers at the time of the hoe's first public demonstration near Woodland, Calif.

No doubt you have watched men on the street breaking up concrete with pneumatic paving breakers and can therefore imagine what several workers with King's air-operated hoes can accomplish. The latter, however, are not powered by paving breakers, but by similar-acting, lighter tools known as sand rammers that are widely used in foundries for consolidating sand in molds. The hoes are connected by lengths of hose to a boom hung from an upright attached to a portable compressor pulled by an ordinary tractor; but instead of chopping with his tool, the operator simply steers it along his row to loosen the soil. He can't stop and lean on it, for he is one of a team that moves along with the compressor as it is driven across a field of sugar beets, potatoes, tomatoes, cotton, or other crop.

To sum up: It looks as though compressed air, long a dependable aid to many industries, will soon be serving agriculture equally well.

Carset Bits for Rock Drills

C. H. Vivian



CARSET BITS AND ATTACHMENTS

The new bit has been developed in various sizes for use with an Ingersoll-Rand stud-type drill-rod attachment (left) which is factory-made to accurate specifications and driven cold into the heated end of an alloy-steel Jackrod. The latter operation is readily performed in the field. In addition, one size of Carset bit is available for the standard threaded Jackrod (right) now used with steel Jackbits, and another size soon will be. All Carset bits have both side and center holes.

ROCK drilling is not an exact science and never can be because there is no such thing as standard rock. The layman sees little difference between, say, quartzite and granite, but the rock driller finds a wide divergence in their reactions to his tools. Some rocks drill easily, while others are extremely obstinate. Two types may have the same hardness, as measured by Moh's geological scale, and yet differ so much in structural characteristics as to make them totally dissimilar so far as drillability is concerned.

For that matter, mere hardness is no index to the driller's problems. Very often he has his greatest difficulty with so-called soft rocks. It is not only the rocks themselves that vary, but also the manner of their occurrence. Some formations are solid and consistent, others are unsound and changeful. In some sedimentary and metamorphic rocks such a thing as the angle of the drill hole to the plane of stratification vitally affects the ease of drilling.

These are the reasons why there can be no "universal" rock drill. They account for the fact that manufacturers have been continually modifying the equipment—ever seeking for better drill performance—since the inception of mechanical rock drilling nearly a century ago. It has been stated on good grounds that the modern rock drill represents the expenditure of more effort and money than any other tool of comparable size. Its designers have made great progress, and each passing decade brings further improvements. However, they recognized long ago that there could be no such thing as an all-purpose drill. Instead, they have given us numerous machines, each intended for a certain type of work. These range in weight from as little as 6 pounds for hand-held tools to 300 for the largest drifters, and up to 600 and more for some of the special drills used for deep-hole quarry work and submarine drilling. And among machines of the same general class there are different sizes

Determining which drill is best fitted for a particular variety of rock is a clinical matter. Manufacturers of drills test each new model thoroughly, but it is physically impossible for them to try it out under all the countless drilling conditions that exist throughout the world. That is why a machine that performs satisfactorily in one place may unexpectedly make a poor showing elsewhere in similar-looking rock. It explains why a single construction or mining operation confronted with two or more varieties of rock may use a different drill in each.

It can be seen, then, that a monumental amount of trial-and-error procedure has gone into the development of today's rock drill. It still goes on, and will continue as drill designers pursue their quest for more efficient machines. This effort concerns the average citizen because the cost of drilling rock affects us more than most of us realize. It enters into the building of highways and all other public works that are paid for with taxes, and the many public and private dams, powerhouses, and other construction projects that are financed directly or indirectly by those who purchase the services they render. Of even greater effect on our pocketbooks is the cost of breaking rock or ore to produce steel, copper, limestone, and other metals and minerals that are converted into numberless articles vital to our daily lives.

Along with the evolution of the rock drill has come a growing interest in drilling accessories. The drill itself is merely a means of applying power. The cutting element at the end of the drill steel does the actual work. It makes the holes in which rupturing explosives are placed, and is consequently of paramount importance. Until about twenty years ago, all rock was drilled by a one-piece rod with a bit forged on one end. In the early years of the art of rock drilling was tried every conceivable pattern of bit from the single-edge chisel type to elaborate geometric designs. In the end it was found that a 4-point bit with two sharpened cutting edges crossing each other at right angles would best serve most requirements.

For some years thereafter the main concern of drill manufacturers was to obtain the best possible steel for drill rods. This was not accomplished as easily as it sounds. The cutting end had to be such that it could be hard-

A BIT THAT DRILLED 1000 FEET

Antonio V. Tallarico, who has run rock drills in various parts of the country and worked on Grand Coulee Dam and other large projects, is shown surveying a 2-inch Carset bit that had drilled 1000 feet of hole and was still in service. It was used with a 4-inch-bore X-71 drill on an FM-2 wagon mounting on a road-relocation job carried out by Geo. M. Brewster & Son, Inc., near Clinton, N. J.

ened sufficiently to do its work without premature dulling and yet not be so brittle as to shatter under the multiple impacts. Meanwhile, the driving end had to be kept soft enough to avoid damaging the tool-steel drill piston striking it some 2000 times per minute at high speed. Moreover, the rod as a whole had to be sufficiently tough to resist breakage induced by fatigue. These difficulties were multiplied by the progressive development of harder-hitting drills and by the tendency to use higher air pressures to give them still greater power. For a long while much of the drill steel utilized in the United States came from Swedish mills, which had an advantage over us in starting out with iron ore of greater purity.

The next forward step was a 2-piece drilling element—a bit and a rod. The results of this improvement were added convenience and an increase in drilling economy. Weighing on an average less than a pound apiece, the bits have become virtually off-the-shelf items of merchandise. A driller going underground in a mine, for instance, can carry his day's supply with one hand. Only the bits have to be brought up for resharpening; the heavy, cumbersome drill rods stay below for many shifts before they require attention. Dulled bits are reconditioned from four to six times on most jobs.

Greater precision in dimensions is obtainable both in manufacturing and resharpening detachable bits than is possible with one-piece steels. Thus each bit that goes into a hole is only $^1/_{16}$ inch smaller in gauge than the preceding one, whereas a $^1/_8$-inch difference was previously the rule. This makes it possible to start deep holes at a smaller diameter than before and still attain the same bottom size. Consequently, less rock has to be drilled, and speed of penetration is increased. Since they were introduced approximately fifteen years ago, detachable bits have firmly established their advantages and now do most of the world's drilling. The savings effected by them are particularly evident in mining and tunneling operations.

The divorcement of the bit from the drill rod permitted metallurgists to choose for each element the metal best suited for it and removed the necessity for the inevitable compromise in the case of one-piece steels. In short, it opened the door to specialization in material and design and launched exhaustive programs of investigation that were aimed at capitalizing still further on the advancements already registered.

It was only natural that the possibilities of ultrahard metals for bits should be explored. This was not exactly a new approach, as the tipping of cutting edges with stellite and similar indurate materials had been tried long before detachable bits were available. The results of these efforts were negative chiefly because the foundation metal gave way under the continual battering, making it impossible to maintain sharp cutting edges. However, the tests served to stimulate interest in hard-metal bits, and this was quickly revived when detachable bits were introduced and provided opportunities for applying the idea successfully. Further experimentation led to the conclusion that the problem could best be solved by forming the entire cutting portions of a suitable hard material rather than by merely tipping the edges.

Fortunately, about 30 years ago, German scientists discovered that an extremely hard compound could be produced by heating powdered metallic tungsten with carbon. The material, called tungsten carbide, was too brittle, however, for most industrial services. This shortcoming was partially overcome by adding cobalt as a binder, but so much brittleness remained even then that the application of the metal was confined largely to the making of dies for drawing wire and inserts for tools used in machining cast iron. However, further improvements were gradually made, many of them by American manufacturers.

By increasing the cobalt content and including titanium and tantalum carbides as binding agents, a material was developed that would machine steel without breaking in the process. This cemented tungsten carbide was employed extensively in the production of practically every major implement used in World War II. Cutting tools made of it had up to 100 times the service life of the toughest tool steels, worked at five or six times greater speed, and held their sharpened edges ten to twenty times as long.

In the meantime, the Germans had begun to experiment with tungsten-carbide inserts in rock-drill bits. As early as 1932 they introduced bits tipped with Widia, their name for the material. These were small-diameter bits for drills that hit much lighter blows than American-made machines. Under those conditions the bits worked satisfactorily, and it is significant to note that even at

the height of the war, when tungsten carbide was in great demand for machining operations, the Nazis continued to allot an adequate supply to keep the mining of strategic metals going. One reason for this no doubt was that, with the ranks of miners depleted, the carbide bits enabled subnormal crews to get out the required tonnages of ore.

Several other European countries adopted carbide-insert bits, either obtaining the German product or making their own of similar design. Beginning in 1942, they were used extensively in Sweden and Norway in mining iron ores. Meanwhile, the Germans attempted to introduce them in the gold mines of South Africa, but they were too brittle to stand up under Rand mining practices. In Europe they were employed with small hand-held drills and stopers, and the air pressure was never higher than 75 psi. With few exceptions, the bits were of the chisel or 2-point type.

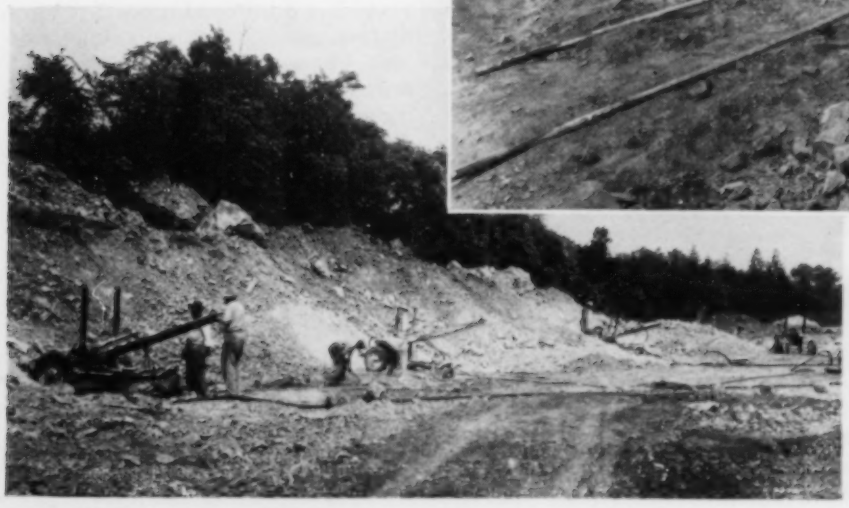
Although few of the foreign-made bits were exported, American drill manufacturers watched their development closely and tested them periodically. Their research convinced them that, while the insert idea had merit, changes were necessary to produce bits that would work satisfactorily in the United States. It was immediately apparent that a 4-point cross bit would have advantages over the chisel type, even though it would require a larger amount of expensive carbide for inserts. Because such a bit offered double the surface for the distribution of both gauge wear and impact, it promised longer life and better performance than the European type which, it was proved, could not take the pounding imposed by our fast- and heavy-hitting drills that are customarily operated at air pressures of 90 psi. and upward. Other indicated needs were a less-shatterable carbide compound and an improved technique for brazing the inserts securely in the slots of the bit.

Because of the urgent demand for tungsten carbide in war plants, no sustained effort was made in America to apply the material to rock drilling until the conflict was over. The job was then tackled in earnest, and the first domestic hard-metal insert bits appeared on the market about eighteen months ago. One of these, called the Carset, is a joint development of Ingersoll-Rand Company and Carboloy Company, Inc., largest American manufacturer of cemented tungsten carbide.

The first Carset bits underwent months of rigorous testing at the Ingersoll-Rand shops, where they were used to drill blocks of Barre, Vt., granite, a rock that can be considered "average" in mining and tunneling operations. Although the friability of the inserts was expected to create the principal problem, it was exceeded by the difficulty encountered in keeping the carbide members in their slots. As experiments continued, the shortcomings they divulged were corrected, one by one. At an early stage in the work the bits averaged 70 to 90 feet of drill hole before failing. When they were released for commercial use the footage had been increased to 225. Drilling speeds of 25 to 30 inches per minute were recorded with medium-weight drifter drills, and up to 50 inches with heavy drifters.

As was previously pointed out, manufacturers' tests of any rock-drilling equipment do not tell the whole story. For one thing, they are usually conducted under controlled conditions which, understandably, are favorable to the product. This is true to some extent even when factory representatives are sent into the field to try out new machines. Moreover, they cannot possibly test them in more than a few of the almost limitless varieties of rock in existence. A factual and complete appraisal of the performances of the new bits must await reports from customers who put them to work under diverse conditions, including different types of drills operating under a wide range of air pressures, operators of varying degrees of skill and experience, and rock of many kinds. Only when a representative cross section of such field opinions is obtained does the designer definitely know what he has fathered.

Tungsten-carbide insert bits are now undergoing this acid test of customer approval during which they must stand on their own under the critical eyes of hard-rock men. Manufacturers don't object to this, for they realize that they are wasting their time if the equipment they have developed is no better than that previously available. They know for certain, though, that they will get the



WHERE CARSETS SERVED WELL

Two views of Ingersoll-Rand wagon drills on the Brewster job putting in inclined toe holes at the base of an embankment being removed to relocate U. S. Highway 22. Drill rods up to 20 feet long were used, as shown in the picture above.

HUNDRED POUNDS PRESSURE

Carset bits on the Brewster job stood up for hundreds of feet of drilling under constant pounding by heavy drills operating at 100 psi. pressure. The pictures show two Mobilair portable compressors and the gauge on top of the air receiver.

real answer from those men, and that is what they want.

"Case histories" collected from typical projects and representing a fair cross section of the experience accumulated to date indicate that Carset bits are living up to the most optimistic hopes of their originators. Already they have inspired the saying that "there is no longer such a thing as hard-drilling rock." Enough has been learned to make it clear that this new drilling element will vitally affect the economy of rock excavation in mining, quarrying, tunneling, and general construction work.

These reports from the field show that one Carset bit will equal the footage of up to 100 steel bits when drilling rock ranging from soft to average hardness. In drilling the most obdurate rock they are outlasting steel bits by 200 or 300 to 1, and in some cases even 400 to 1. In other words, the superiority of the new bits as regards endurance is greatest in the rock or ore in which steel bits do not stand up well. Consequently, they promise to make their most pronounced savings in materials that are now the costliest to drill. The advantages of Carset bits as to durability and drilling speed result in better drilling cycles, faster breaking of rock, and lower costs. For mines this not only means greater profit from ores currently minable but also brings much "marginal" ore into the commercial range. For all types of construction calling for the excavation of rock it means a reëvaluation of drilling costs.

LOADING BROKEN ROCK

Material drilled with Carset bits on the Brewster job was broken by economical blasting into sizes that could be shovel-loaded with very little secondary shooting.

Typical of the numerous reports are the few that follow: An iron mine that had been spending an average of 49.8 hours in drilling a 5½-foot round in a 12x20-foot drift found it could put in a 6½-foot round in 18.5 hours with Carset bits. The saving was $92.69 per foot of drift. Another underground mine, working quartzite, required an entire shift for drilling a round and had to defer blasting until the second shift. With Carset bits, drilling speed has increased so greatly that the same shift does both drilling and blasting. Steel bits and drill rods cost a third mine 46.4 cents per ton of ore mined. When Carset bits were adopted the outlay dropped to 27.8 cents per ton, a reduction of 40 percent.

A company carrying out an $800,000 contract was drilling basalt with wagon drills. When using steel bits, ten changes had to be made in putting down an 18-foot hole, and the drilling time was 66

minutes. By comparison, one Carset bit completed a 24-foot hole in 22 minutes. As a result, the shift-footage per drill was increased from 120 to 261 feet. It is estimated that Carset bits would have saved $75,000 or more if they had been available throughout the duration of the job.

It should be pointed out that, in addition to direct savings in drilling time and cost, there are various incidental economies in connection with the use of the new hard-insert bits. Important savings are effected by Carset bits because they drill a hole of uniform diameter and it is no longer necessary to start a deep hole with a comparatively large bit in order to insure bottoming it at the desired size. Actually then, a Carset bit has less rock to drill, which is one reason why it does its work faster. Furthermore, less air is needed to drill this smaller quantity of rock, and air consumption is cut by 40 percent or more. In many instances this will make it possible to utilize lighter, less expensive drills for a given job. Also, because Carset bits stay sharp for long periods they put less strain on drills. The latter consequently require less maintenance.

Steel bits dull quickly and have to be changed frequently, and with each succeeding change a longer rod is used. Inasmuch as one Carset bit will drill hundreds of feet of hole in most types of rock, bit changing is practically eliminated and rod changes have to be made only when the drill has run the length of its feed. Thus, on operations such as tunnel driving, where multiple-drill carriages are employed, the number of drill tenders or nippers ordinarily required may be reduced.

Not all the savings attributable to Carset bits are made at the drilling location. Important economies are registered in the reconditioning shop. An occasional touching up of the Carboloy inserts on a grinding wheel is all the bits need. Furnaces and milling machines required for resharpening steel bits are rendered unnecessary, and considerable shop labor may be diverted to other work.

The first Carset bits put in service were of 1½-inch gauge. Soon they will be offered in several graduated sizes up to 2 inches. The bits are designed for use with a factory-made alloy-steel stud attachment that is driven into the heated end of a Jackrod, a combination that gives best results. However, a 2-inch-gauge bit of the new type is now available, and a 1¾-inch soon will be, for use with the same threaded drill-rod connection employed with steel Jackbits of those sizes. In addition to the sizes for conventional rock drills, Carset bits are also being made in four sizes ranging from 5¼ to 6 inches for Ingersoll-Rand Company's newly developed Quarrymaster drill.

NEW BIT FOR QUARRYMASTER DRILL

The Quarrymaster, recently introduced, is a self-contained, air-operated rig for drilling large-diameter blast holes. It will put down holes up to 6 inches in size to depths of 70 feet and more at greater speeds than is possible with any other type of equipment. It is designed especially for heavy-duty service in quarries, open-pit mines, and coal-stripping operations. The unit shown is working on a road-construction job in New York State. At the top is pictured the 5½-inch Carset bit that has been developed for use with this machine. Reports from the field show that individual bits are drilling 1000 feet and more in highly resistant taconite iron ore before requiring attention.

Huge Air System Serves Rand Gold Mines

PHOTOS FROM SOUTH AFRICA INFORMATION SERVICE

JOHANNESBURG

Founded in 1886, when gold was discovered on the Witwatersrand, Johannesburg has become the mining and commercial center of the Union of South Africa and its largest city, with a population of 760,000. Above is an aerial view of the central section of the city, with some of the mine dumps in the background. The variety and extent of Johannesburg's traffic are evident in the upper picture, which was taken at Eloff and Pritchard streets.

ONE of the largest compressed-air distribution systems in existence serves the gold-mining industry of South Africa. There, as in a few other mining districts of the world, major operations are so concentrated that air can be supplied for most of them through a network of mains, thus eliminating the need of individual compressor stations at each mine. This puts the production and distribution of compressed air on a basis comparable to that on which municipalities are furnished with electricity, gas, and water. Such a scheme obviously has economic advantages. Outlying mines must, of course, maintain their own compressor plants, as is the rule with mines and industrial establishments the world over.

Pioneers in the compressed-air field visualized piping air around cities for use in factories and households, and this was actually done in some places, notably in Paris. Electricity meanwhile proved more suitable for general service and displaced compressed air in some of its original applications. In the Transvaal of South Africa, however, electricity and compressed air work hand in hand, and both are considered indispensable. In fact, these public utilities are transmitted to the mines by the same organization.

In the beginning, each mine had its own compressors all driven by steam. Because the thirteen properties in the Rand Mines group were close together, the advantages of a central air-supply system soon became apparent, and it was decided to put one in. For this purpose the Rand Mines Supply Company was organized as a subsidiary of the Victoria Falls & Transvaal Power Company, Ltd. Starting in a small way and then gradually enlarging its facilities, that concern has built up the present network of piping that delivers air to all the mines in an area 16 miles long. It operates twenty compressors driven by motors with a total capacity of 128,000 hp.

Air is fed into the distribution mains from compressor plants at Rosherville, Robinson, and Canada. The Rosherville Station was constructed in 1910 and equipped with six 4000-hp. turbocompressors. In 1915 three 9500-hp. units were added, followed in 1930 by a 15,000-hp. machine, which was at that time the largest of its kind ever built. Since then, three more, ranging from 7000 to 10,000 hp. each, have been installed. In the meantime, four of the original 4000-hp. compressors have been taken out of service. The present horsepower capacity of the Rosherville plant is around 75,000.

Also in 1910, six 4000-hp. turbocompressors were put in the Robinson Station located at the Robinson Central Deep Mine near Fordsburg. All these units are still in use and have not been supplemented. The Canada Station was established in 1932 when need arose for an additional supply of air in the western section of the Central Rand. It was situated there to obtain cooling water from the reservoir created by the Canada Dam. Two 7000-hp. compressors were initially set up, and since then two more of identical size have been installed. Besides these facilities that feed the central distribution system, the utility supplies air to the Brakpan Mines from a 10,000-hp. station at that property.

On the Rand, compressed air is bought and sold by the unit. This arrangement was made at the request of the mines, and it was determined that the quantity of air in a unit should be such that its price could be set at the figure the operators were paying the Victoria Falls & Transvaal Power Company for a unit of electricity. In other words, the unit was fixed so that it would cost the mines about the same as it would if they electrified their steam-driven compressors and bought the power from the utility.

The initial rate was set at 0.525 pence (1.05 cents) per unit, which was based on the weight of the air contained in a unit at different pressures. It ranges from 30 pounds (483 cubic feet of free air) at a delivery pressure of 80 psi. to 25½ pounds (410 cubic feet of free air) at a delivery pressure of 120 psi. These quantities were computed to be approximately those that would, on a weighted

MINE HEADFRAME

In its 61 years of activity the Rand has produced and treated more than 1½ billion tons of ore that yielded approximately 440 million ounces of gold. The 45 large mines now operating hoist around 60 million tons of ore a year. Some of the workings are 9000 and more feet deep, and there are cases where lower levels are air conditioned to reduce excessive heat.

average, have been delivered by the various existing compressors at an expenditure of one kilowatt of steam energy. A series of tests was conducted to determine the weighted-average efficiencies of the compressors.

The Rosherville, Robinson, and Canada compressor plants are interconnected by piping up to 27½ inches in diameter and from which the distribution system extends the length of the area served. Nearly half of the air is consumed within 2 miles of a compressor station, and 80 percent within 3 miles, while no customer is more remote than 5 miles. The contracts stipulate that the delivery pressure shall normally be between 100 and 110 psi. and that it shall not drop below 90 psi. at any time. Relatively short branch lines take off from the distribution mains to feed the various mines. The arrangement of the mains gives all mines except those east of Rosherville an alternate source of supply. This duplication was not provided because of a fear of line breakage but rather to permit maintenance work without interrupting service.

The air discharged from a compressor station is measured by means of plate orifices and venturi tubes inserted in straight sections of piping beyond tne main stop valves. The pressure drop across these orifices as shown by water manometers is recorded at half-hour intervals, and from these readings is computed the output of air units by referring to a chart that has been especially prepared for the use of the operating staff. Maximum delivery through the distribution system is around 310,000 cfm. In an average year, customers are supplied with approximately three million long tons of air. One year's sales totaled 268 million units.

The air contained in the system at normal temperatures and pressures amounts to around 70 long tons, which is equivalent to 2½ million cubic feet of free air. This is calculated to be about 8 minutes' supply for the mines under maximum operating conditions. Transmission losses between compressor stations and the mines average 5 percent of the units sent out, and virtually all this shrinkage is attributed to the drop in pressure caused by friction and cooling. Normal loss through leakage is considerably less than 1 percent.

The purchase of compressed air in bulk at a flat rate relieves the mines concerned of heavy capital investments in compressor plants. The favorable rate that results from central-station compression reduces operating costs and permits mines to use air more extensively than they probably would if each had to supply its own. However, it has not created a tendency towards wasting compressed air or applying it inefficiently. On the other hand, mine staffs are continually on the alert in these respects.

The principal use of compressed air on the Rand is for operating rock drills, of which more than 8600 are in service. It is also drawn upon for operating hoists, pumps, drill-steel sharpening machines, forge hammers, and foundry tools; for ventilating remote sections of mines; for opening and closing ore-chute gates and safety doors over shafts; and for similar auxiliary purposes. At some mines, air pistons push the "cocopans" of ore on to the tippling platforms. A few properties that formerly had steam hoists have found it more economical to discontinue the boiler plants and convert to air operation. Losses of a steam plant are considerable when standing by, whereas they are very small in the case of a compressed-air system.

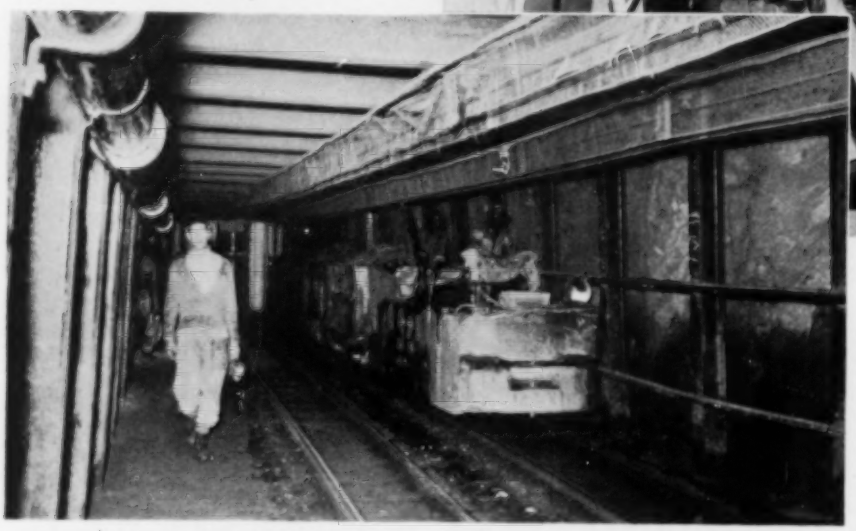
Aside from its acknowledged advantages for operating rock drills and other percussive tools, compressed air is of

CHAMBER OF MINES BUILDING

The Transvaal Chamber of Mines is a clearing house for matters of common interest to the operating companies and has done much to advance the administration and technique of gold mining. Among its other varied activities, the chamber operates a large modern hospital in Johannesburg where native miners are given free treatment and care.

MINING SCENES

Nowhere else is mining technique farther advanced than on the Rand. By using modern methods and equipment in combination with native labor, the mines are able to make a profit from ore that averages only about $7 a ton in gold content. The view below shows a main haulageway with an electric locomotive drawing a train of 4-ton cars of ore. Upon reaching the surface the ore is conveyed to the crushing mill by belt, as illustrated at the right.



value for other reasons in the Rand mining district. Most of the mines are deep and the workings are hot. Because compressed air absorbs heat from the atmosphere when doing work, it is an important cooling agency and also serves as ventilating air.

As previously mentioned, the Victoria Falls & Transvaal Power Company got into the business of selling compressed air because it was already generating and distributing electric power, and the mines considered it desirable to put these two utilities on the same plane and to buy them from the same source. The name of the company stems from the fact that in 1895, when mining on the Rand was making its first great strides, the idea of developing power at Victoria Falls and transmitting it to the mines seemed to be ripe for exploitation.

The scheme is said to have been discussed at that time by Sir Rider Haggard and Prof. George Forbes, who was the engineer for the first hydroelectric plant at Niagara Falls. W. A. Wills, who was Haggard's partner and the holder of large concessions in Northern and Southern Rhodesia, suggested that Forbes ask Cecil Rhodes for a concession at Victoria Falls. Upon doing so he learned that H. B. Marshall had made a similar request. Rhodes decided to grant the concession jointly to the two applicants, who thereupon formed the African Concessions Syndicate.

Having worked up the necessary engineering data, the concessionaires launched their project in 1904, and two years later organized the Victoria Falls & Transvaal Power Company and registered it in London. Preliminaries had included studies of water-power plants at Niagara Falls and in Europe. The African scheme was an ambitious one, as it involved transmitting energy a distance of 700 miles, whereas the longest existing line was 110 miles. The plan fell through for two reasons: Weakness of the securities markets in London prevented the underwriters from disposing of the offered stock, and then the Transvaal Government declined to grant permission to import power on the grounds that it would hurt the local coal mines.

In view of these developments, the promoters investigated the matter of establishing local steam-driven generating plants and found, in fact, that they would be cheaper than to transmit hydroelectric energy from Victoria Falls. As a result, the company entered upon a program of building stations at selected sites, which were largely determined by their proximity to bodies of water of ample size to serve the steam condensers. At that time there were in the area only two power plants with an aggregate capacity of 4000 kw., and they were taken over to form the nucleus of the Victoria Falls power system.

As the mining industry grew, new stations were constructed and subsequently enlarged a number of times. By 1915, the installed generating capacity totaled 167,200 kw. Notable expansion of the mining industry following World War I called for further increases in power facilities and inaugurated a new development program that has continued more or less steadily ever since. The present output is more than 900,000 kw. and the Klip Station alone can produce 425,000 kw.

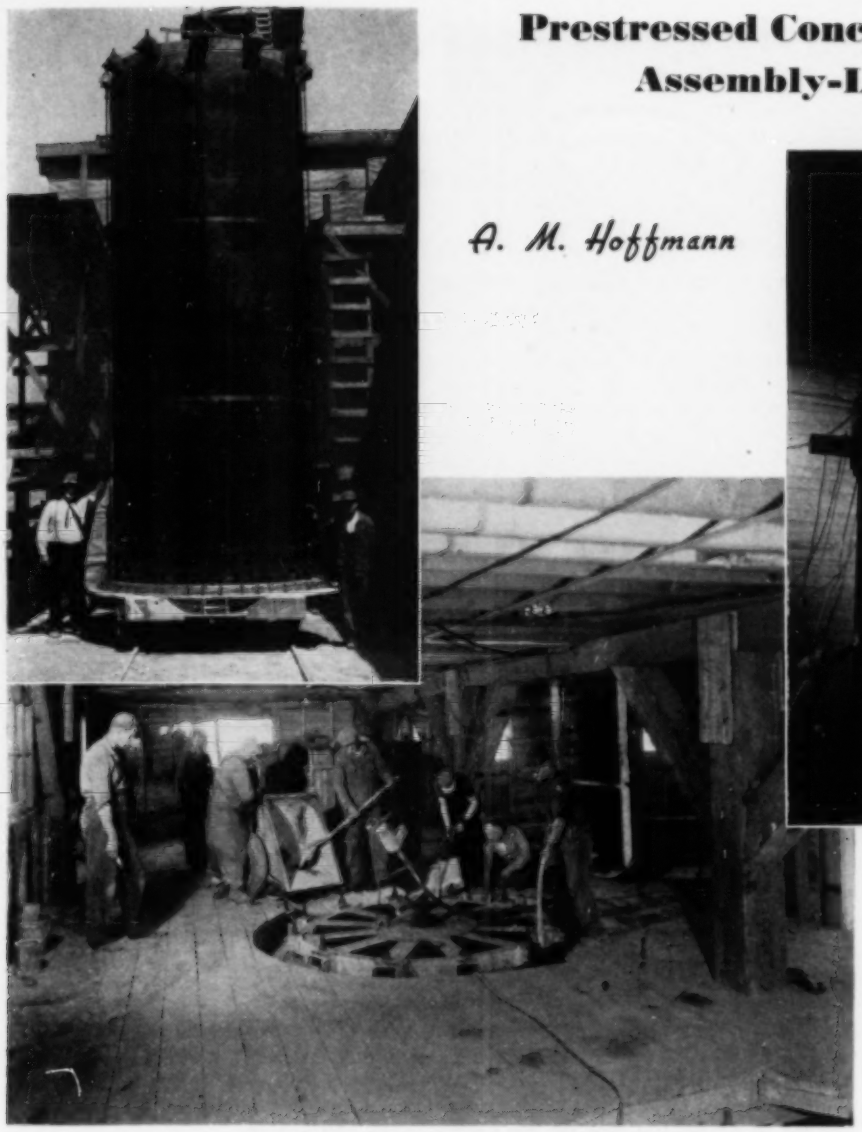
In 1922 the government passed the Electricity Act which created the Electricity Supply Commission, and since then well-nigh all the new plants have been built for it by V.F.P. and operated by the latter. Last summer the Electricity Supply Commission began negotiating for the purchase of the V.F.P. holdings, and a price of 14½ million pounds (approximately $58,000,000) was agreed upon. The transfer of assets is now being carried out. Henceforth the government agency will sell both electricity and compressed air to the mines.

The Rand power transmission system extends for 150 miles in an East-West direction. In general, current is delivered at 40,000 volts and is reduced by transformers at the mines to the various voltages at which it is used. In many instances cables carry it down shafts at voltages of from 3300 to 20,000, and it is then stepped down by underground transformers. Elaborate precautions are taken to protect the distribution network under emergency conditions, and each piece of apparatus is equipped with sensitive instruments that instantaneously disconnect it in the event of insulation failure.

In order to investigate faults, motion-picture cameras have been set up at strategic points and automatically go into action when high-voltage surges are induced by lightning or other causes. The cameras record the readings on instruments that show the behavior of various types of electrical machinery under such circumstances. Run in slow motion, the films have proved valuable in research work designed to overcome damage and outages that are attributable to emergency conditions.

Prestressed Concrete Pipe Made by Assembly-Line Methods

A. M. Hoffmann



MANUFACTURING STAGES

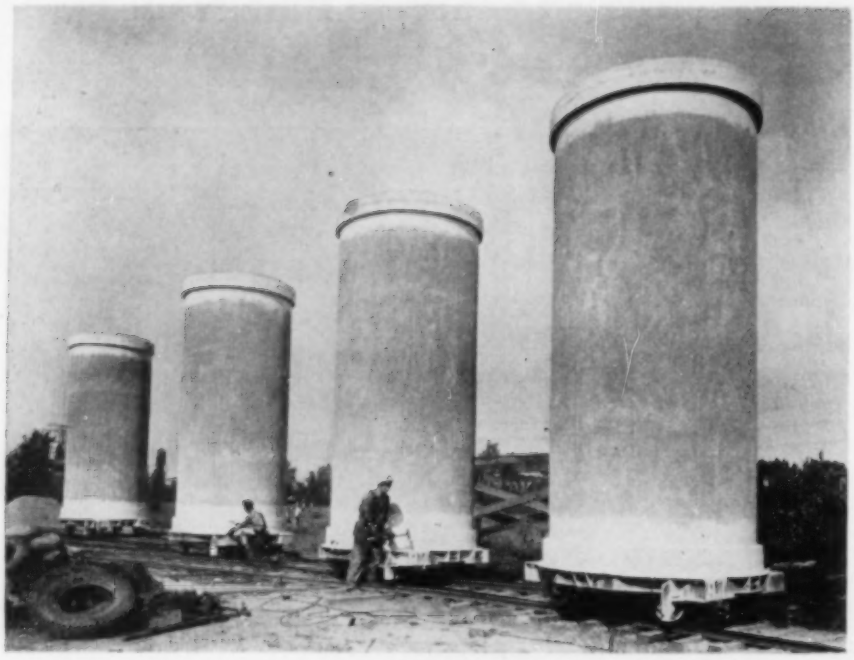
The view at the top-left shows the inner steel form accurately centered on a car and with the longitudinal reinforcing in place and prestressed. The reinforcing consists of 24 strands of high-tensile-strength steel wire, 0.44 inch in diameter, which are spaced in sets of two at equidistant points around the form. Each pair of wires is given a predetermined unit stress by tightening the top and bottom anchoring nuts with an air-operated wrench. Directly above is pictured the upper platform of one of the three pouring sites where the outer forms are erected. Note the heavy wooden spider to which the longitudinal reinforcing is secured. Concrete for the intake pipe was placed in two 9-foot lifts and compacted by means of two vibrators. At the right is one of the huge cores, still car mounted, in the process of wire winding. Left of the cylinder is the upright steel track with the wire-drawing device a little above the half-way point. The latter is moved by two endless chains engaging sprockets on shafts at the top and bottom of the I-beam track. The lower sprocket shaft is driven through gears from the turntable countershaft, thus synchronizing the winder and turntable rate of travel.

TO MEET an increased demand for water, the City of Montreal has recently built a new water-supply intake from the St. Lawrence River of prestressed pipe of an unprecedented size manufactured by a method that eliminates the conventional steel diaphragm and permits prestressing both longitudinally and circumferentially. Each section is 18 feet long, has an inside diameter of 7 feet, a wall thickness of 5½ inches, and weighs approximately 16 tons. A total of 532 lengths was required and was made according to the design and procedure of The Preload Company of Canada, Ltd., in the plant of the Atlas Construction Company.

As described by R. M. Doull, general manager of The Preload Company, the new pipe is produced pretty much along assembly-line methods. To start with, the inner form is mounted on one of 27 special cars that run on standard-gauge track and are shifted from one working place to another by air winches. The form is a steel cylinder with a single longitudinal joint which makes it possible to reduce its diameter sufficiently to withdraw it from the concrete pipe or core. This is accomplished by a series of levers that extend from a central column to the inside wall of the shell and contract the latter when the column is lifted by aid of a shackle at the top.

When erected, the cylinder is moved to the next station where the longitudinal reinforcing is attached. In the case of the intake, it consisted of twelve pairs of wires provided with special nuts, one at each end of a set. The reinforcing was spaced at equidistant points around the perimeter of the shell and anchored to tapered bolts extending through the car body and, at the top, through the arms of a heavy frame resting on the form. After initial adjustment of the tension by hand and torque wrench, the wires were uniformly prestressed by tightening the nuts with a pneumatic wrench. The assembly was then transported to one of three pouring sites at each of which were two working platforms, one about 9 feet above the car and the other level with the top of the cylinder.

To facilitate handling, erecting, and stripping, the outer steel form was made up of four rings each 4½ feet high and divided into three segments. They were set up a pair at a time, with the bottommost flanged section bolted to the car, to permit pouring in two lifts. No holdup in operations was occasioned, because the erection crew followed right on the heels of the concrete crew as it pro-



READY FOR SHIPMENT

A group of pipes approaching the end of the assembly line, where each is lifted by a 25-ton traveling crane from the car on which it was made from start to finish. Air winches are used to move the cars, which run on standard-gauge track. Switching is done by turntables to save space. A machined plate on top of each carrier serves as the inside form for the bell end of the pipe; and a hub, bored concentrically with the plate, centers the 18-foot-long inner pipe form and, later, the concrete core during the winding operation.

ceeded from one pouring station to another. The outside shell was removed for cleaning, oiling, and reuse the day after pouring.

With the inner cylinder still in position, the partly completed pipe was hauled into a steam chamber, which is large enough to accommodate twelve cars on double tracks. Temperature and relative humidity were maintained at 90-100°F. and 100 percent, respectively, during a curing period of 72 hours' duration. At the end of that time the top bolts holding the longitudinal wires were removed and the inner form was contracted, withdrawn, and mounted on another car after overhauling.

At this stage the core is ready to receive the circumferential reinforcing, which is applied by a winder built especially for the purpose. It has two parts—a wire-stressing device and a 10-foot diameter turntable mounted on twelve adjustable rollers revolving around a heavy pneumatic ram that engages a hub on the car to center the pipe on the table during winding. No top support is needed. Driven by a 25-hp. variable-speed motor through gears, the table can be turned at a speed of 200-300 feet a minute. The essential features of the stressing device are a power-operated traveler carrying a wire-drawing die and running on a steel track parallel to the pipe axis.

After it is threaded through the die, the wire, fed from a reel through guide pulleys and rollers, is fastened to an anchor cast in the lower flange of the concrete core. A similar anchor in the top flange holds the reinforcing until the cover coat is applied. The wire-drawing device permits continuous winding regardless of a variation in pipe diameter. This is effected by embedding another anchor in a recess at the point of changeover. Thus the barrels of the 18-foot sections were wound at a pitch of 0.63 inch and the flanges at 0.31 inch without cutting the reinforcing. As each length required about 500 pounds of wire, or 1⅔ coils, it was necessary to make at least one splice.

The outer cover was next applied to a thickness of ½ inch. This work was done with a cement gun using a mix composed of one part of cement to four parts of sand and containing 5 percent by weight of hydrated lime. A 365-cfm. compressor driven by a 75-hp. motor supplied the air for guniting, as well as for the operation of the winches, concrete vibrators, and pneumatic tools used in the plant. After a definite setting period, the pipe was run to the end of the production line and into a second curing chamber where the outside coat received the same treatment the core had undergone earlier. Finally, the finished product was lifted from the car by the yard derrick and transferred to a hydraulic test bed or to storage. An average of three 18-foot pipes was manufactured each day.

As compared with pressure-type concrete pipe of conventional design and equal size, each length represents, it is claimed, a saving of 3000 pounds of steel, or a total for the St. Lawrence intake of 1,596,000 pounds.

Concrete Used in Mine to Support Ground

BACK in 1939 the Climax Molybdenum Company, operator of what is said to be the world's largest molybdenum mine, began to experiment with concrete as a substitute for the timber and steel sets that were used to support the ground at points where fingers branch off from slusher drifts. Subsequently, the drifts were completely lined with such success that approximately 90,000 cubic yards of concrete has been placed in the underground workings since then to maintain blocky ground. Today it is the practice also to concrete grizzly-chamber cutouts, areas around chutes and overcasts, etc.

The sand and coarse aggregates required for the purpose are stored in hoppers on the surface and are accurately weighed and loaded into a car with 24 compartments, each of which holds enough material for a ½-cubic-yard batch. There are three of these cars in service. They are designed for bottom discharge onto a conveyor belt that delivers the material to a mixer, where cement is added by hand. From the mixer the batch is elevated by another conveyor belt and dumped into the hopper of a Pumpcrete machine from which it is forced through a 6-inch pipe line into steel forms. The equipment runs on 36-inch-gauge track and has poured as much as 2700 cubic yards in one month.

DURABLE FLOOR

The floor of this shot-blast room in a New England textile-machinery factory is surfaced with fabric-backed Armorite, a Goodrich rubber that is compounded especially to resist abrasion. The covering reputedly showed no appreciable wear after a year of service, while the old 2-inch plank floor generally had to be replaced once a month.

The Heat Pump

It Defies a Law of Physics by Ostensibly Delivering More Heat Than is Contained in the Energy that Operates It

HOME heating without fuel has become a reality with the development of the heat pump. Operating on the principle of refrigeration in reverse, the device draws heat from the earth by circulating a liquid in buried piping. Although designed primarily for heating, it is also equipped to transfer excess heat back into the earth, thus functioning as a year-round air-conditioning unit. At the present time, several manufacturers are experimenting with the system and some companies are offering equipment for home use.

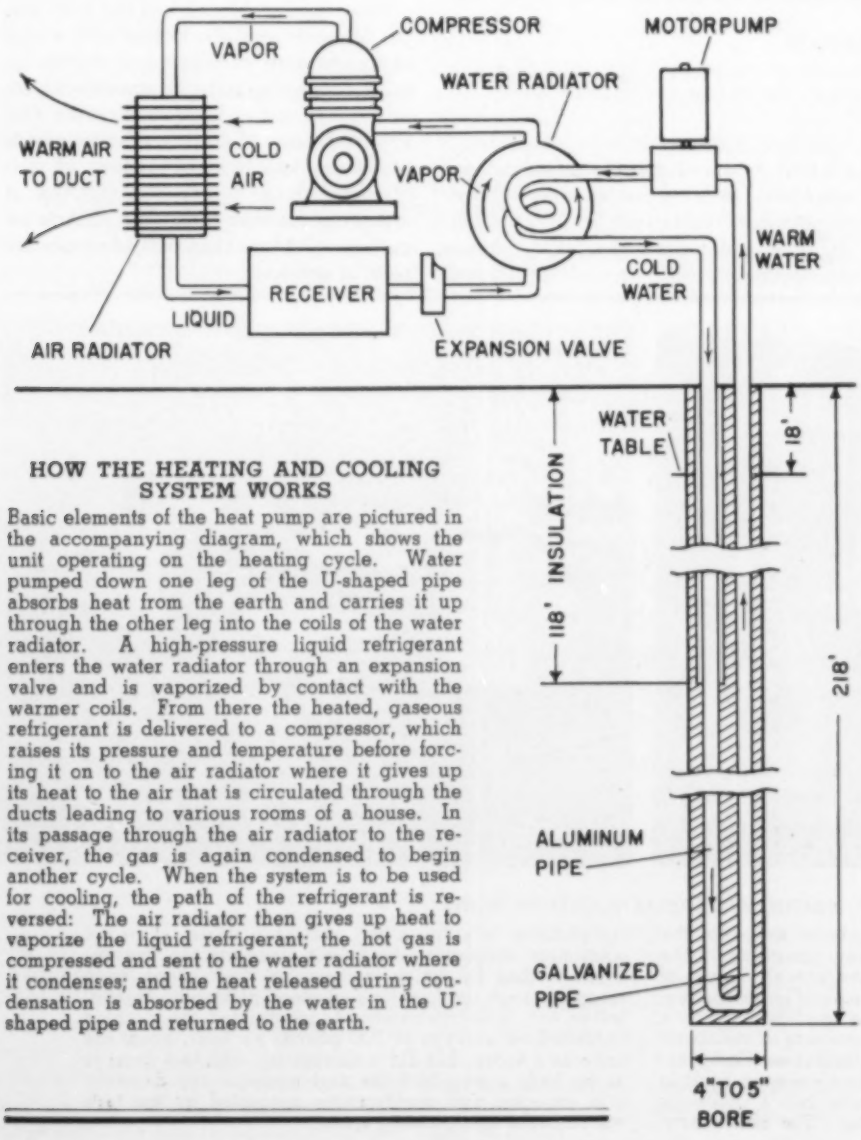
Refrigeration in reverse has long been recognized as a possible substitute for heating by burning fuel. A refrigerator pumps heat from a cold interior to the warmer atmosphere. Tests with similar apparatus have shown that heat can be pumped into a warm interior from the cold outdoors. However, except in mild climates, the atmosphere is not the best source of heat; it is not a satisfactory reservoir upon which to draw either in hot or cold regions. In the case of the latter, the capacity needed to handle temperatures of 20°F. and lower increases sharply, and serious trouble may be caused by frost forming on the outdoor equipment. Both these extremes may be disregarded if the earth is used as a source of heat and tapped for the purpose by a well or deeply buried pipe.

One of the most interesting of the available systems is manufactured by the Muncie Gear Works of Muncie, Ind., and utilizes a 200-foot well. Water pumped through piping in the well picks up heat from the earth and delivers it to the air-conditioning unit, from which conventional ducts carry warm air to all parts of a house in winter. When operating in reverse, it provides cooling air, which reaches the rooms through the same ducts. Under conditions of high humidity, excess moisture entrained in the air is condensed before the latter is circulated. The air is also filtered to remove dust and dirt. The main features of the unit, which has been named Marvair, are an expansion valve, a water radiator, a compressor, and an air radiator, all housed in a metal cabinet 40 inches long, 28 inches wide, and 34 inches high that may be installed in the basement or on the ground floor of a structure.

Three electric motors using 230-volt, 60-cycle, single- or 3-phase current, furnish power for the system. The water in the well piping and water-radiator coils, from which a liquid refrigerant absorbs heat for vaporization, is handled by a fractional-horsepower I-R Motorpump. The latter is of the centrifugal type and develops only enough pressure to overcome friction encountered by the water in its movement through the piping, thus insuring positive circulation at minimum pumping cost. From the water radiator the now gaseous refrigerant enters the compressor, which serves to raise its pressure and temperature. This machine is driven by a 3- or a 5-hp. motor, depending upon its size. Another fractional-horsepower motor operates a blower that forces air through the house ducts by way of the air radiator, where it absorbs heat from the refrigerant. In giving up its heat, the latter condenses and flows back into a receiver to start another round. The cycle is reversed for cooling.

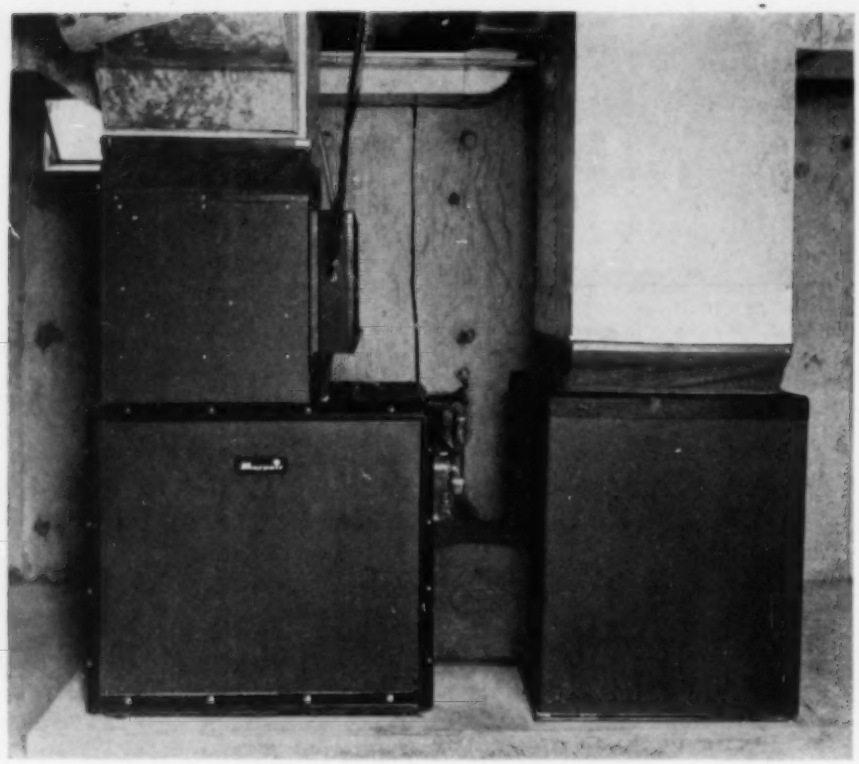
Four solenoid valves functioning in pairs effect the change from heating to cooling, and back again. Controlled by a thermostat, the valves reverse the direction of flow of the refrigerant with the help of check valves and auxiliary piping. Control is entirely automatic, and once the thermostat is set at the desired temperature, that temperature is maintained closely winter and summer alike.

The U-shaped piping or heat exchanger has a minimum inside diameter of 1 inch. However, if the bore of the



HOW THE HEATING AND COOLING SYSTEM WORKS

Basic elements of the heat pump are pictured in the accompanying diagram, which shows the unit operating on the heating cycle. Water pumped down one leg of the U-shaped pipe absorbs heat from the earth and carries it up through the other leg into the coils of the water radiator. A high-pressure liquid refrigerant enters the water radiator through an expansion valve and is vaporized by contact with the warmer coils. From there the heated, gaseous refrigerant is delivered to a compressor, which raises its pressure and temperature before forcing it on to the air radiator where it gives up its heat to the air that is circulated through the ducts leading to various rooms of a house. In its passage through the air radiator to the receiver, the gas is again condensed to begin another cycle. When the system is to be used for cooling, the path of the refrigerant is reversed: The air radiator then gives up heat to vaporize the liquid refrigerant; the hot gas is compressed and sent to the water radiator where it condenses; and the heat released during condensation is absorbed by the water in the U-shaped pipe and returned to the earth.



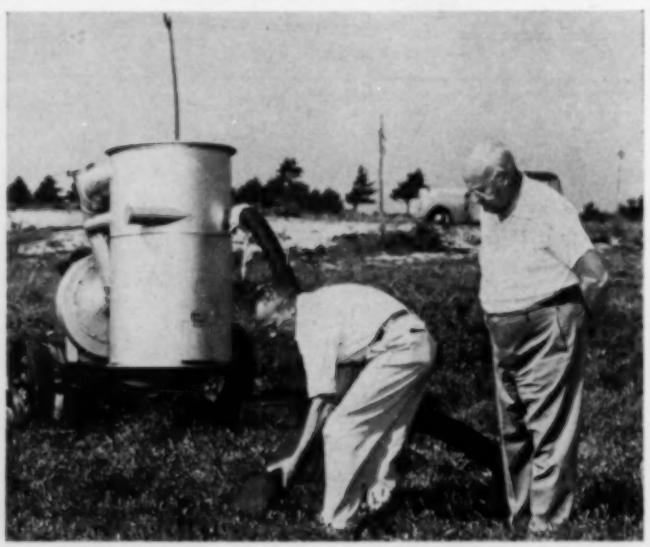
THE MARVAIR

This compact assembly serves as a year-round air-conditioning unit, dispensing heat in the winter and coolness in the summer. The change can be made merely by operating four valves.

well permits, it may be of larger size and will result in a reduction in power required to circulate the water. The leg of the closed circuit which carries water down into the well is of aluminum in order to obtain the best possible heat transfer. It is insulated from surface-temperature variations by a 1½-inch-diameter galvanized pipe that extends approximately half way down the well and is sealed at both ends to provide a dead air space. The well should have a minimum finished bore of from 4 to 5 inches and an average depth of 200 feet below the water line, depending upon the locality.

The heat pump is an important step toward the all-electric home. While the rate for current may be relatively high, the system moves four or more times the equivalent in heat under favorable conditions and may therefore cost less to operate than a standard furnace. As compared with 400 and more percent of heat obtained from the energy required to operate the unit, a furnace delivers on an average 50-60 percent of the thermal units in the fuel. Although a heat-pump installation calls for a considerably greater investment than a furnace, the difference is discounted by the fact that the former can be used for summer cooling as well as winter heating. Other advantages of this new method of air conditioning are: safety, cleanliness, elimination of manual labor such as is associated with solid fuels, and the convenience of fully automatic control for year-round comfort.

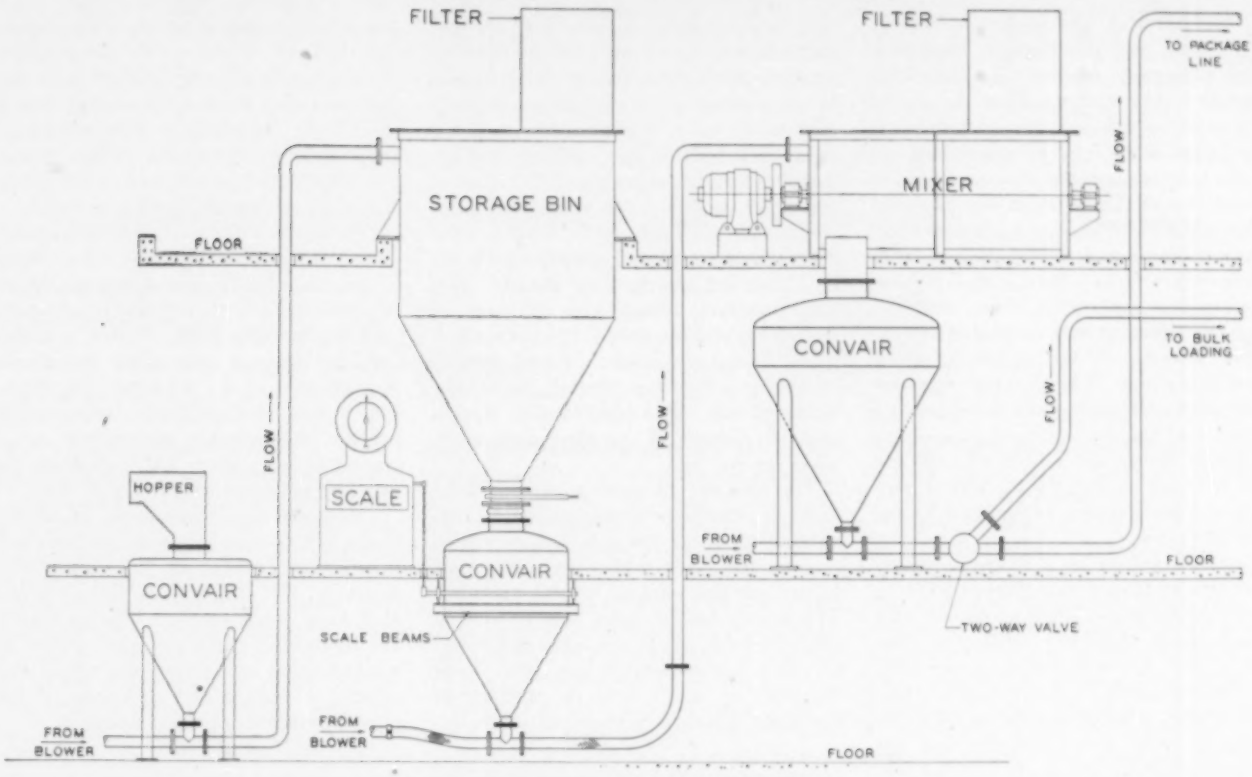
Since the introduction of the Marvair, the Muncie Gear Works has built a unit equipped with a compressor driven by an engine using natural, manufactured, or bottled gas. Experience with this type indicates that its operating cost is something less than 50 percent of that of conventional gas heaters and that it is more economical than the electric installation. More than 500 Marvairs are now in service.



VACUUM VERSUS HAND PICKING

There will be an abundance of cranberry sauce for the nation's Thanksgiving tables this year, according to the Department of Agriculture, which has forecast a crop of 875,000 barrels of cranberries, the second largest on record. Harvesting of the fruit may be revolutionized by a machine that was developed by the growers in collaboration with engineers of the United States Rubber Company. It works on the principle of the vacuum sweeper, sucking up the berries through a rubber tube into a container lined with rubber to prevent bruising. The accompanying pictures, taken on a bog at Hanson, Mass., show the equipment undergoing field tests alongside the conventional method by which workers, on their knees, push scoops through the low, tangled vines, picking up berries, leaves, etc., indiscriminately. As constructed, the machine harvested an average of 100 pounds an hour, about the same as a scoop, but did a cleaner job with less damage to the buds upon which the next season's crop depends. It is expected that modifications suggested by the tests will increase the operating speed.

Pneumatic Conveying System Uses Low-Pressure Air



HANDLES BAKING INGREDIENTS

The system shown here is being used by a firm that produces baking mixes. Four different kinds of flour, granulated and powdered sugar, powdered shortening, leavening, skim- and whole-milk solids, powdered eggs, and cocoa arrive at the plant in bags and barrels. The materials are dumped into the hopper above the first Convair activator, which delivers them to steel storage bins. From there they drop into the weighing activator, which is accurate to within 1/10 of 1 percent, and blown by it into the mixer. The latter feeds 3500-pound batches to another activator which, in turn, delivers them to a bulk loading station or to a small-package line. By the self-cleaning feature of the Convair system, different cake mixes can follow one another without any becoming contaminated.

PNEUMATIC equipment for conveying lumpy, granulated, or powdered material by the use of low-pressure air or gas has been developed by the Convair Corporation for chemical, food, glass, steel, and other industries where large amounts of such products must be unloaded, stored, mixed, and transported to various locations. The system differs from conventional types in that the material is first dumped by gravity into a conically shaped activator. Air at 5-15 psi. pressure introduced at the bottom of the unit blows the contents over short or long distances through flexible piping that can be installed vertically or horizontally, overhead or underground.

Materials ranging in size from 500 mesh to half the size of the pipe and in weight from 10 to 350 pounds per cubic foot have been handled, and it is said that batches made up of light-weight and heavy ingredients are conveyed without segregation. For batching, there are activators with multiple compartments each of which is connected to a storage bin. The separate products are automatically weighed as they enter their respective sections and, combined, are fed into the pipe line where they are thoroughly blended by the stream of air.

In the case of a system designed for a glass plant, however, the different batch ingredients, including cullet up to 2 inches in size, are mixed before they reach the activator. Through the medium of suitably hung piping, this single-compartment unit charges ten glass tanks. The travel distance is 700 feet, and conveying time for a 3000-pound batch is said to be 65 seconds. This conveyor handles four different mixes. The operation is entirely automatic and in charge of one man at a central control panel.

Where the use of air is not permissible because of the nature of the material, such as pthalic anhydride or cellulose acetate, an inert gas is substituted and returned to the blower for recirculation after filtering. A blend of air and fluorine or other gas also may be employed so that grain, for instance, can be treated to check mold or lessen insect infestation while it is being conveyed. Furthermore, the system can be designed to extract moisture from materials carried and thus function as a drier. An installation of this type is handling wet resin in a chemical and plastics plant and reducing the moisture content from 3½ to less than 1 percent in a travel of 170 feet.

Cost of maintenance of the Convair, as the conveyor is called, is said to be low because the blower is its only moving part and because the use of a low- instead of a high-pressure conveying medium considerably reduces wear on piping, especially elbows. Air or gas is admitted to the system only during the operating cycle and can be varied in volume from 50 to 30,000 cfm., making it possible to regulate the flow of material per hour from pounds to tons.

Subway riders probably won't believe this, but The B. F. Goodrich Company promises patrons of Chicago's new Dearborn Street line a ride so smooth that it won't crack an egg shell. Perforated rubber pads will be sandwiched between the ties and tie plates upon which the rails will then be laid. It is claimed that the rubber has a remarkable cushioning effect and will retain its resiliency for 50 years. In addition to rider comfort, the pads will prolong the service life of rails and cars. They are improvements upon similar ones in use on Chicago's State Street subway.

Air Teams with Vacuum in Rotary Filter

LITTLE did the inventor, Frank Young, and the builder, Bird Machine Company, suspect that their continuous rotary vacuum filter, developed just prior to the war, would become a key factor in the mass production of one of the most important new products of recent years. Their filter was designed primarily for continuous, high-flow operation unhampered by anything that might restrict the effectiveness of vacuum as the separating force, and the uses for which it was intended in the chemical and pulp and paper industries were numerous. These, however, were temporarily set aside when it became apparent that the war-induced demand for penicillin would exceed all bounds and that it could be met by the aid of continuous filtration such as the Bird-Young filter provides.

Let us examine for a moment the remarkable and comparatively recent process by which penicillin is produced on a gigantic scale. Literally trillions of "Oxford units" are now being made daily (an Oxford unit is "that amount of penicillin which, when dissolved in 50 milligrams of meat extract broth, just inhibits completely the growth of the test strain of *staphylococcus aureas*").

To provide the amount of penicillin that is now required annually, millions upon millions of gallons of liquid have to be handled. The culture or organism must be coaxed into infinite multiplication in multistory fermentation tanks containing a special nutrient "beer." After several days of fermentation, the solid matter, known as mycelia, must be removed from the beer by filtration, and from the clear liquid thus obtained the penicillin is extracted by absorption, using an organic solvent for the purpose. The latter is then distilled, leaving a concentrated residue of pure, snow-white penicillin. This is put in tiny glass vials that are chilled at about 100° below zero Fahrenheit, dried in an almost absolute vacuum, and automatically sealed and capped under ultraviolet light and the most sterile conditions.

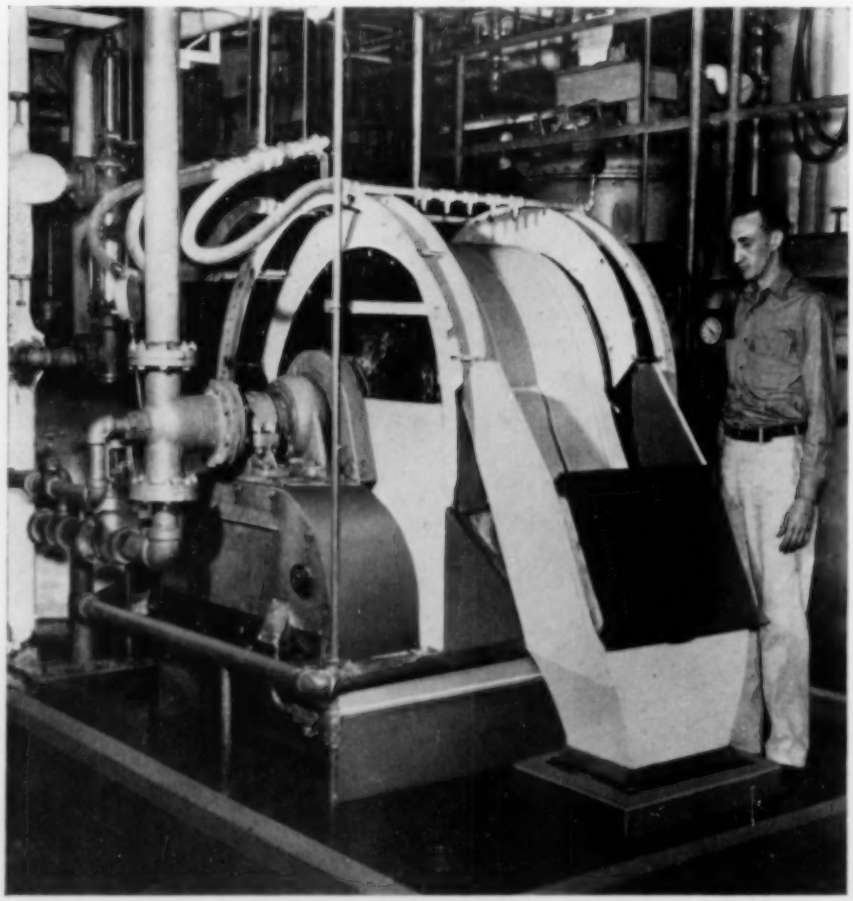
You will notice that filtration plays an important part in this process. It was found that ordinary equipment would not do because the mycelia and its growth were unpredictable in character. One batch would filter readily enough, and the next would be seemingly impossible to filter by established methods, with the result that the entire batch would have to be thrown away, precious penicillin and all. The Bird-Young filter proved to be just what was needed for this tricky operation. It was adopted for the first mass-production plant and has been installed in more than a score of such establishments since that initial application four years ago.

It is interesting to see how air and vacuum are put to work in the filter to separate solids from liquids continuously in big volume. The equipment consists essentially of a multipaneled cylinder which is subjected to a vacuum and rotates partially submerged in a non-settling-type vat. The outer surface of the cylinder is made up of several hundred small perforated panels which do not obstruct the flow of liquid. The filter medium, either wire or cloth, is supported and securely locked at each of these drainage panels. Large hollow trunnions offer the filtered liquid unhindered exit. The construction is such that 93 percent of the filter area is always on the job.

The cylinder contains a blow-off conduit in which a comparatively large volume of air at low pressure serves to remove the filter cake—the solids that collect on the surface of the cylinder. This gentle, intermittent blast of air dislodges the filter cake throughout the full area of a narrow section at a time, doing the work so neatly that no scraping of the filter medium is required as in the case of conventional filters. Using air for the removal of the solids has another advantage because it loosens and discharges a thin layer more readily than a thick one. The result is correspondingly faster cylinder operation, higher capacity, more thorough washing of the solids, and more complete liquid removal.

Offering as it did a solution of the penicillin producer's problem, the Bird-Young filter has, in the meantime, found application in other fields confronted with similar difficulties. Today, it is also used in filtering fine clays which are notoriously slow filtering materials, costly dyes and pigments, fatty acids, rubber accelerators, and many other essentials to modern life, including the new and effective weed killer 2, 4-D.

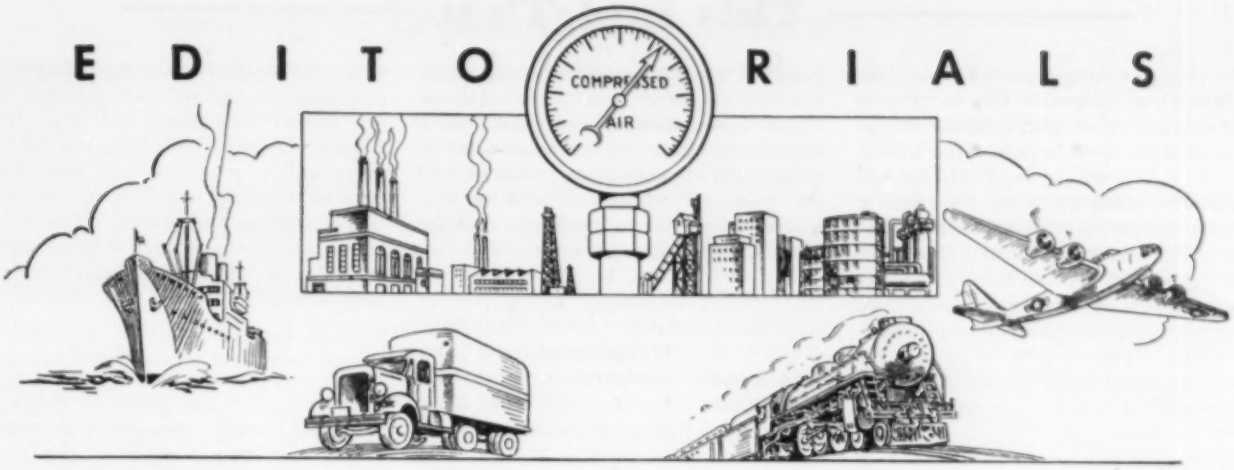
There are many instances where the fruits of war-born emergencies have had far-reaching effects on peacetime production. Not the least of the advances that have come about in this manner is the method of using air and vacuum in solids-liquids separation on which the quality of many end products of the process industries largely depends.



FILTER IN ACTION

Coming off the revolving drum is penicillin mycelia, which is loosened and cleanly removed by jets of compressed air. The filtered liquid flows out of the machine through the hollow trunnions. This unit, with a filter area of 25 square feet, handles 2000 gallons of penicillin broth per hour.

EDITORIALS



FARM AIR POWER

READERS of these pages need hardly be told that the use of compressed air is ever on the increase. From the time the first mechanical compressor was devised, which was probably just about a century ago, pneumatic power has been important. Before electricity was brought to the practical stage, enthusiasts hailed compressed air as the future all-around servant of mankind. Schemes were advanced for local and long-distance transportation of goods and people by air pressure and vacuum. In some places were laid distribution networks to pipe air from central compressing stations to small shops and households for the purpose of running such machinery as then existed. Pneumatic clocks are still operated by systems of this kind.

Compressed air didn't turn out to be an all-purpose medium of power transmission, but it did continue to thrive. Electricity, once considered a rival, has become more of an ally. For one thing, it provides a convenient, efficient, and economical source of power for compressors and vacuum pumps. Nowadays, electricity and compressed air often work hand in hand. Although there are numerous applications where either can be used, their individual fields are, for the most part, pretty well delineated.

Human ingenuity has harnessed pneumatic power in so many ways, and so many new applications are appearing all the while that the air-consumption curve is steadily rising. It would be hard to locate a factory of appreciable size that does not have at least one compressor. Most industrial plants find it profitable to keep adding to their source of air supply, and it is considered common sense when buying a new unit to provide a little extra capacity to take care of needs that are bound to arise before long.

Agriculture is the only large branch of industry which does not make extensive use of air power, and there are definite signs that it, too, is beginning to feel the pneumatic touch. The spectacular increase of mechanized mobile farm equipment has created a demand for small compressors for inflating tires, operating paint sprays, etc. In some sections of the country traveling service stations make regular rounds to minister to the farmer's needs, but in time virtually every farm of fair size will want its own compressor, grease guns, pneumatic tools, and allied maintenance equipment for the convenience they afford.

Of wider scope is the opportunity that exists for air power in the growing and harvesting of field and orchard crops. Anyone who doubts that this work offers a prolific field for the compressed-air industry need only read the first article in this issue. It describes divers pneumatic machines and devices that are serving California agriculturists. It is significant to note that most of them were originated by the farmers themselves and built by them in their own shops. They did this of necessity, for so far few manufacturers have concerned themselves with the possibilities of air power on the farm. Needless to say, the opportunities will not long remain overlooked.

THE PROFIT MOTIVE

AS CHILDREN we were taught the wisdom of the squirrel's habit of putting some food away for the winter. Thrift has always been commended, and every ambitious worker hopes to save enough to permit spending his declining years in leisure. Paradoxically, a considerable segment of our population assails industry for amassing profits. Its members apparently believe that corporations should pay out essentially all the money they take in.

This shallow thinking fails to take account of many factors. An individual need concern himself only with providing financial security for a lifetime, and he is assured certain monetary benefits when he gets old. A corporate body, on the other hand, has no such life span. It hopes to continue in business through the generations, and it has to plan accordingly. Moreover, it knows that it will encounter adverse conditions from time to time, and it must be financially entrenched to weather the storms.

Today, more than ever before, industry must look ahead if it is to endure. To hold its place, a concern must advance. This does not necessarily mean that it must grow bigger, but rather that it must keep abreast of new developments in its line. Industrial firms move forward through research, and in so doing benefit everybody concerned, including their customers, employees, and stockholders.

In a recent address, Henry B. du Pont, a vice-president of the Du Pont Company, defended the profit system. He called earnings the "seed money" with which industry sows for the future. This "seed money," he declared, is just as important to a small business as to a large one. It makes expansion possible at a time when it is needed. A taproom owner, he pointed out, may spend his profits for a television set to attract more customers, while a big corporation may put surplus earnings into a research program costing millions of dollars. In both cases the principle is the same.

As an example of the fruits of research, the speaker cited what has taken place in the rayon industry. As introduced, rayon was a poor textile and few people wanted it. The fibers were coarse, of little strength, and objectionably shiny. Today the shine has been eliminated, the filaments are finer than those of silk, and their strength has been doubled. These improvements have been made while reducing the price of the material to one-fourth its former level.

As its part in these developments, the Du Pont Company spent $30,000,000 in research, and other firms appropriated comparable sums. The result is a rayon industry that embraces fifteen yarn manufacturers, 150 weaving mills, 575 converters, 585 dyeing and finishing establishments, approximately 3500 garment manufacturers, and some 9000 retail outlets. All told, it employs 1¼ million persons. Profits of the firms from earlier operations made all this possible.

This and That

Unloading Cement with Air

Air pressure is frequently used in this country to transport cement through pipe lines, the most common case of this kind of pneumatic pumping being the transfer of bulk shipments from railroad cars to storage silos at large construction projects. A similar scheme is employed by a cement mill at Limhamm in southern Sweden for expediting deliveries to nearby areas. The cement is carried by trucks equipped with two airtight metal containers having a capacity of more than 2 tons each. These are loaded through openings at the top. A 2-inch pipe extends from the bottom of each unit and is fitted with a connection for a rubber hose. Another section of pipe extends through the side wall and is connected to an air compressor mounted on the truck.

The containers are filled at the cement mill, sealed, and weighed. At the destination the driver attaches a suitable length of hose, starts the compressor, and transfers the cement to whatever storage facility the customer has provided. Sufficient air pressure is available to move it a considerable horizontal distance, and up to 50 feet in height. This method has been found to be more economical and convenient than transporting cement in bags.

* * *

Canadian Oil Output Increases

Canada passed an economic milestone this year when, for the first time, its oil wells yielded a million barrels of petroleum in one month. This mark was reached in June and was principally due to an output of nearly 400,000 barrels from the recently developed Leduc Field in Alberta. In the first six months of the year, Leduc produced 1,283,000 barrels, as compared with 25,500 barrels in the same period of 1947. Turner Valley Field, long Canada's most prolific source of crude oil, is now declining chiefly because it was drawn upon heavily during the war years.

Leduc was brought in by Imperial Oil Limited after it had spent some $16,000,000 since 1939 in searching for commercial fields in the far western provinces. After sandstone strata had failed to show production, a test well that penetrated a deeper horizon of Devonian limestone "blew in" on February 13, 1947. Since then three additional producers have been brought in and other wells are being drilled. Meanwhile, the provinces of Manitoba, Saskatchewan, and Alberta are not providing enough petroleum to keep their refineries operating at their rated capacity of 40,000 barrels daily, and crude is being imported from as far away as Texas and Louisiana. Canada, as a whole, can meet only a small part of its demand for petroleum products, and the quest for additional fields is continuing at a cost running into millions of dollars annually.

* * *

Pneumatic Cable Watchdog

If experiments now being conducted at Caldwell, N. J., are successful, much of America's aerial telephone-cable system may some day be kept under air pressure. Pressurizing is being tried out as a means of eliminating interruptions in service caused by breaks in the lead sheathing. These are most often experienced when a sudden cold rain contracts and cracks the cable sheath after a warm period. The infiltrating moisture then wets the telephone wires and service is impaired.

Cables in the Caldwell area are now being charged with compressed air under 7 psi. pressure. Gauges in the Caldwell central office will immediately register any drop in pressure when air is escaping through a break in the sheathing. Instruments will indicate its location to an accuracy within 20 or 30 feet, and steps will be promptly taken to detect and patch the rupture. Meanwhile, the escaping air will prevent rain from seeping in and interfering with service. The New Jersey Bell Telephone Company reports that the pressure system will go into operation early next year. Caldwell was selected for the experiment because it is a typical central-office area as to size, type, and cable distribution.

* * *

Find New Arctic Islands

Incredible though it may sound, the Canadian Government recently discovered two unknown islands in the Arctic Circle. They have a total area of 5000 square miles, and the larger one is two or three times the size of Prince Edward Island. They were found on July 14 when an RCAF photographic plane was returning from a tour north of Hudson Bay. While over Foxe Basin, off the west coast of Baffin Island, the pilot sighted land through a break in the clouds. He thought his navigation had been faulty, as the plane was then supposed to be over water, and accordingly revised his estimated time of arrival at Frobisher, on the southern end of Baffin Island. However, at the revised arrival time the craft was still 60 miles from its base. A check flight disclosed the existence of the islands, which were later marked on the map and photographed from the air. It was at first believed that they were mud flats that showed up only at low tide, but further investigation revealed that they were covered with the usual northern vegetation of moss and lichen. The larger of the two pieces of land is 85x75 miles, the other about 20x10 miles. Both have been added to Canada.

* * *

Traffic Not New Problem

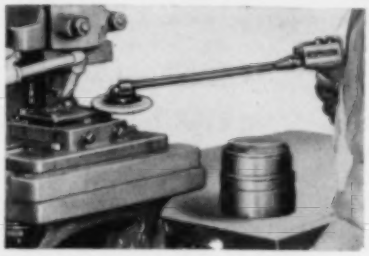
We are prone to think of traffic congestion as something peculiar to the modern age, but it has existed, albeit in a different degree of intensity, for more than a century. Last month, when the American Society of Civil Engineers entered into a discussion of Boston's master highway plan for solving traffic problems, it was recalled that the subject considered at the group's first meeting on January 5, 1853, was traffic congestion. At the time, attention was directed to a plan for "The Relief of Broadway" in New York, and the society's president, James Laurie, submitted a drawing and description of a scheme for the construction of an elevated railway as an aid in handling the crowds. Last month's meeting was also informed that wagons were so numerous on Boston's streets in 1820 that they were prohibited after a certain hour in the evening from passing over the neck of land that then tied the city to the mainland.

* * *

Novel Use of Freezing

Unusual, to say the least, is the use of mechanical refrigeration to freeze ground in Arctic regions where the natural temperature frequently reaches 75 degrees below zero. Why that is done was revealed last month by C. M. Spofford, Boston consulting engineer, in a paper before the American Society of Civil Engineers. His firm built some structures in the "permafrost" area, where the earth is permanently frozen to depths of as much as 1500 feet. The buildings gradually transferred some heat to the ground on which they stood, and in a few years thawed bowl-shaped pockets in it. Where the permafrost region consists of fine-grained soils having a high moisture content, thawing lessens their load-carrying capacity, and some building failures have resulted in consequence. To overcome this condition, excavations are dug adjacent to the foundations, pipe coils are installed, and a refrigerant is circulated through them to refreeze the ground.

Industrial Notes



Safety in feeding flat work such as metal blanks to punch presses is the purpose of a small tool made by F. J. Littell Machine Company and named Pres-Vac. It has a suction cup at one end and a pistol-grip handle at the other end of an extension that is long enough to keep an operator's hand out of the danger zone. Vacuum is induced by compressed air at 20 to 45 psi. controlled by a trigger on the handle.

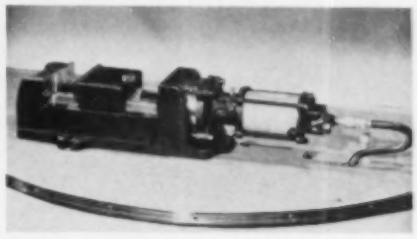
Something of a departure in sanding wheels recently introduced by Nu-Matic Grinders, Inc., features a rubber drum that can be inflated with air at 3 to 10 pounds pressure to meet service requirements. The drum is 5 inches in diameter and takes a 3½-inch-wide abrasive band. Fitting onto any power-tool shaft, running at different speeds, and using grits of varying grades, the adjustable sander is designed to give irregular, curved, or flat surfaces a wide range of finishes.

What is said to be the world's first plant for the commercial production of synthetic glycerine from petroleum was dedicated recently at Houston, Tex. The process was developed by a research affiliate of Shell Union Oil Corporation and represents one of the major achievements of a program begun by that organization nearly twenty years ago in an attempt to create a new industry based on petroleum chemicals. Heretofore, glycerine has been obtained almost entirely as a by-product in soap manufacture and was one of the critical materials of which there was a shortage during World War II.

A photoelectric cell that has nearly four times the vision of the ordinary "electric eye" has been announced by the Canadian General Electric Company. Present equipment of this kind has a maximum range of 275 feet, with an average of 50 feet. The new cell is said to be effective up to 1000 feet. Its light source sends out a beam that is modulated or interrupted 900 times a second; and the distant relay responds only to light at that frequency and causes alarms, signals, counters, and other electrical devices to function when the ray focused on it is broken by an object. Sun or rain or changes in natural light therefore do not affect the far-sighted electric eye, which has various applications including the counting of vehicles on highways, operating traffic signals upon the approach of vehicles, and closing restricted areas.

V-belts reinforced with steel cables are a product of Browning Manufacturing Company. The reinforcing is an integral part of the carcass and makes it possible to use fewer belts on a given load or to carry heavier than normal loads with safety. Called Steel Cable Gripbelts, they are available in A-, B-, and C-section types from stock with pitch lengths of 27 to 113 inches, 36.4 to 240 inches, and 53 to 240 inches, respectively. Because of the cables there is a minimum of stretch which, it is claimed, virtually eliminates slippage and increases service life.

Designed primarily as a heavy-duty milling-machine vise, Bellows Model DVH air-hydraulic unit is suitable for other work such as forming, marking, swaging, coining, and staking. Initial power is supplied by an air cylinder and is increased from an air-line pressure of 100 psi. to a clamping pressure of 15,000 psi. by a built-in hydraulic intensifier. Maximum air pressure recommended is 125 psi. The jaw opening is adjustable from a fraction of an inch to a maximum of 5 inches in increments of $\frac{1}{32}$ inch through a positive-locking nut on the hydraulic ram. There is an adjustable brass jib on the movable jaw to take up



wear, and each jaw is provided with a ½-inch-thick false jaw of hardened steel. Vise may be operated by a manually controlled valve, a solenoid valve for use with interlocked electric equipment, or through the medium of mechanical linkage.

Thumbtacks that prick fingers and have a way of falling on the floor point up to be stepped on are out as fasteners

FIRST CONCRETE PLACED IN BULL SHOALS DAM

Informal ceremonies marking the placing of the first bucket of concrete in the main structure of Bull Shoals Dam, flood control and power-generation barrier being built on the White River in northwestern Arkansas by Ozark Dam Constructors for the Corps of Engineers, U. S. Army. About two years will be required to pour the 2,100,000 cubic yards, into which will go 1,800,000 barrels of cement and 3,700,000 tons of aggregates. The latest estimated cost of the project, which was described in our June, 1948, issue, is $76,300,000. Standing on the platform at the left of the bucket are M. H. Slocum, superintendent for the contractor (left), and Maj. W. J. Klasing, Corps of Engineers. Below and at the left of Mr. Slocum is H. H. Roberts (in white shirt), chief engineer for the contractor. In front of the bucket is Congressman W. F. Norrell, Eighth Arkansas District. On his right are Col. T. A. Lane, Little Rock District Engineer, Corps of Engineers, and Ralph P. Johnson, engineer in charge of the Bull Shoals Dam Project for the Corps of Engineers.

FOR DEPENDABLE PIPE LINES

You Can't Beat this NAYLOR Combination

Naylor lightweight pipe and Naylor Wedge-Lock couplings provide the practical answer for pipe lines in the mining field. This combination adds up to easier handling, time and labor saved on installation, savings in steel and high salvage and re-use value. Ideal for high or low pressure air and water lines. Sizes from 4 to 30 inches in diameter with all types of fittings, connections and fabrications.

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for bulletin boards. Someone has come up with a new idea—a steel board provided with twelve small Alnico magnets each of which is said to have a holding power 33 times its own weight. It is called the Magnetic Pin-up Board.

Airmatic Valve, Inc., has announced a new flow-control valve—the Model FC—for use in connection with pneumatic cylinders. It is designed to regulate the speed of the piston stroke or air exhaust without loss in cylinder power and thus to simplify machine operation. It is interposed in the air line between the cylinder and the operating valve, or positioned in the line at each end of the cylinder if both the "work" and the "return" stroke are to be controlled. Variable speeds are obtained by adjusting the valve screw, and micrometer adjustment of a stem and specially designed floating poppet is said to insure positive control at any selected speed. Six standard sizes (¼ inch to 1¼ inches) are available for air, oil, or water ranging in pressure from 0 to 1000 psi.

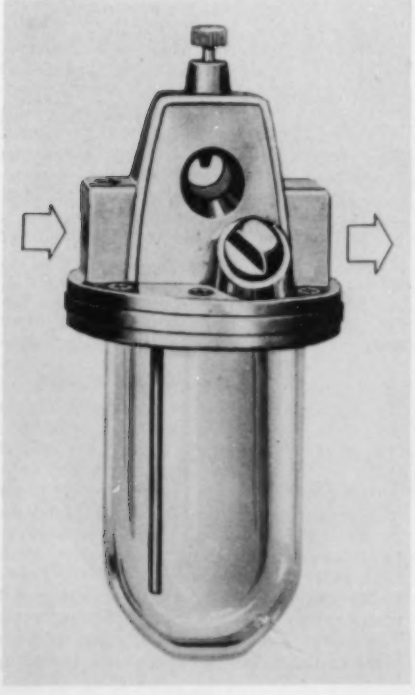
Walking hazards caused by dampness, greasiness, and similar slippery conditions can be overcome, it is claimed, by coating steel, wood, or concrete with Traffic-Tred made by the Industrial Safety Products Division of the Watson-Standard Company. The varnish is applied like paint and gives the floor a hard surface with a sandpaperlike texture. Finish is approved by Underwriters' Laboratories and can be cleaned, patched, or renewed.

About two years ago Shearcut Tool Company introduced a rotary broach that was designed to finish through holes and to feed the removed material ahead of the cutting tool. Now the company announces a rotary broach that forces the chips to the rear so it may be fed to the bottom of a blind hole. The new tool has three or four cutting flutes with sharpened front edges that remove most of the stock left after the drilling operation. Immediately behind them are right-handed helical cutting flutes that remove the remaining 0.006-0.010 of metal and feed the chips backward out

of the hole. Designed primarily for turret lathes and automatics, the Blind Hole Rotary Broach may be used on any machine tool that has power feed to the spindle. Stock sizes start at 3/16 inch and are increased by 1/32 inch to 1 inch and by 1/16 inch from 1 inch to 1 1/2 inches. Special sizes are made to order.

By a mass-production plating process developed and used by the Continental Die Casting Company, automobile hood ornaments are given a 2-tone finish—chrome and gold. The zinc-alloy die casting is first put in a copper and then a nickel bath to harden and to protect it against corrosion. Next, the area to be gilded is covered with a masking material and the casting is chrome-plated. This is followed by the removal of the masking metal and immersion in the gold-plating solution. As a final step, the gold-finished surface is sprayed with a glaze and the ornament is baked for an hour.

An automatic air-line lubricator of new design for pneumatic tools and equipment has been developed by the Hannifin Corporation. It consists essentially of a body with pipe connections and of a transparent-plastic bowl that holds about 1/2 pint of oil. Removal of a filler plug in the body automatically shuts off the flow and releases air pressure in the bowl, making it possible to replenish the supply without shutting off line pressure. Oil is metered into the air stream as a fine mist, and the rate of flow can be regulated by a needle valve. The Series RL lubricator is now available in 3/8- and 1/2-inch sizes, has an overall height of 8 1/2 inches, and is built of noncorrosive materials for line pressures up to 150 psi.



Dry Air from the new filter with the longer-lasting cartridge

Air passing into MICRO-KLEAN FILTER first hits the baffle; any moisture not deflected, enters . . .

MICRO-KLEAN fibre cartridge where it must make hundreds of sharp turns through minute interstices, impinging on fibres.

Longer cartridge life is due to double dirt-collecting capacity and resinous impregnation which prevents wicking or channeling.

Moisture then drains from *non-wicking* fibres into extra-large collection chamber, equipped with petcock drain.

Standard Micro-Klean models handle volumes up to 80 cfm of free air and pressures up to 125 psi. They have been adopted as standard equipment on such widely divergent applications as pneumatic mine-equipment, powder dispensing devices, motor coach auxiliary air systems, spray painting systems, air instruments, etc. For more information, attach coupon to your letterhead.

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REMOVES MORE SIZES OF SOLIDS FROM MORE TYPES OF FLUIDS

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FOR MONEY-AND-TIME-SAVING
***FULL-FLOW* FITTINGS**
AND *TWO-BOLT* COUPLINGS

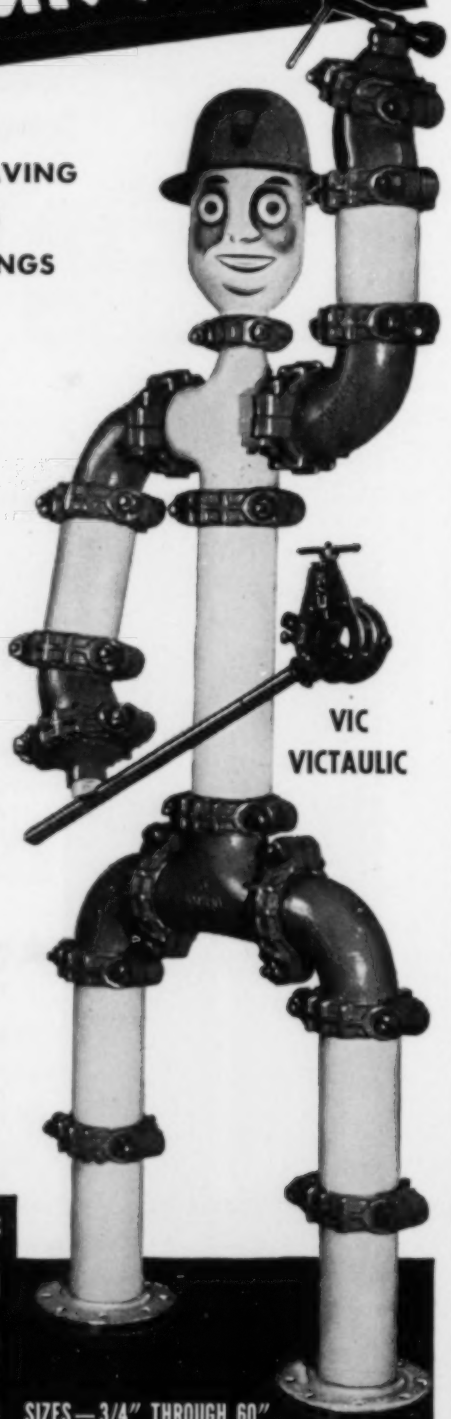
EVERY Victaulic Elbow, Tee and other Fitting is *full-flow* . . . designed with wide, smooth-sweeping turns and true circular walls that increase pipe-line delivery *and lower pumping costs.*

THE TWO-BOLT simplicity of Victaulic Couplings means: just a couple of swift, easy turns of a standard T-wrench buttons up any piping system . . . saving costly materials and valuable man-hours installing, repairing, or salvaging.

VICTAULIC COUPLINGS also build into pipe lines: flexibility that automatically adjusts for contraction-expansion . . . a union at every joint that allows removal of any pipe length, valve, or fitting without damage to pipe ends and without backing off adjoining sections . . . lock-tight, leak-proof joints that can't pull out or blow off under pressure, vibration, or sag.

FOR FULL ECONOMY in your piping system . . . make it *all* Victaulic. And use the new "VIC-GROOVER" that grooves pipe ends twice as fast with only half the effort of regular pipe threaders.

WRITE TODAY for Victaulic Catalog and Engineering Manual No. 44-8 . . . and for the new "Vic-Groover" Catalog No. VG-47.



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Industrial Literature

A 28-page booklet that describes Republic Steel Corporation's cold-finished steel bars may be obtained from the company by writing to Cleveland 1, Ohio. Data on sizes, tolerances, commercial finishes, mechanical properties, and typical applications of the most frequently used types of cold-finished steel bars are given, as well as on machining grades of stainless steel. A section of the publication is confined to the cold-drawing process itself.

Wisconsin Motor Corporation has published a 56-page booklet that deals with the history and development of its air-cooled engines. It illustrates and explains the methods by which they are manufactured from the rough boring of crankcases to the assembly and testing of finished machines. Equipment driven by them is also covered in detail, and the field of operation of each is illustrated. Persons interested in receiving the booklet should address requests to the company at Milwaukee 14, Wis.

Sturgis Products Company, Sturgis, Mich., has issued a 16-page catalogue describing and illustrating its equipment for the mechanical deburring and finishing of metal parts. The process makes use of a mixture of mineral chips, water, and special compounds, the kind and size of chips varying with the operation—deburring, polishing, honing, etc. Work to be finished is placed in an octagonal container into which the mixture is introduced. The unit is then rotated until the desired effect has been obtained.

Brooke Engineering Company, Inc., 4517 Wayne Avenue, Philadelphia 44, Pa., will send to interested readers copies of Bulletin No. 20-A which describes and illustrates its equipment for industrial smoke abatement. Electronic smoke indicators and recorders listed in the bulletin disclose the density of the smoke in the furnace breeching, and controls actuate overfire air jets to keep smoke down to a minimum. The jets are of the steam or high-pressure blower type and can be changed from manual to automatic operation by means of a push-button switch.

National Pneumatic Company, Rahway, N. J., will send upon request an illustrated folder which describes its line of pneumatic "kits" which, when applied to light production machines, convert them to air-powered units. The folder gives descriptions of kits designed for the operation of shearing machines, kick presses, hand-operated milling machines, circular cut-off machines, and drill presses. The kits are said to increase production and, through the use of automatic controls, to insure work of high quality. Each is engineered in the factory to fit the machine for which it is intended and comes complete with instructions for installation.

Literature describing an instrument which determines the tin content of solder is obtainable from Wheelco Instruments Company, 847 W. Harrison Street, Chicago 7, Ill. The device consists of a high-resistance pyrometer equipped with a handle and has two sample cups mounted on the ends of tubes extending from the instrument case. The method by which the percentage of tin in a given batch of solder is obtained depends upon the difference in temperature between pure lead and a lead-tin alloy while both materials are passing from the liquid to the solid state. The sample of pure lead is permanently scaled in one of the two cups. The solder to be tested is scooped into the other cup and retained there until a reading is taken.

Worn Sheaves are on his blacklist

Sheaves, the Bethlehem man will tell you, can be a big factor in the life of wire rope. Whenever he sees a rope that looks "chewed up," one of the first things he investigates is the sheaves. If they're badly worn, he suggests they be replaced or remachined. This is the stitch in time that saves nine—sometimes more.

Soft sheaves are often corrugated by the action of the rope passing over them. The same thing can happen to drums and rollers. These corrugations, or ridges, frequently grow so sharp that they nick and abrade the wires of each new rope installed. When this occurs, and you let it go on, it's just like throwing money away. Keeping a worn sheave – and spoiling a fine rope – is false economy, any way you look at it.

The Bethlehem field man is trained to ferret out such things. That's part of his job. He knows—and he wants *you* to know —how rope life can be prolonged. He'll gladly suggest a few simple precautions—like sheave maintenance – that help turn the trick.

Remember, whenever you need his help in wire-rope matters, it's yours for the asking. No cost, no obligation. Simply call the nearest Bethlehem office or distributor.

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Wagner Motors on the job . . .

A Wagner 100-hp type RP motor installed on a large vertical-type Worthington compressor.

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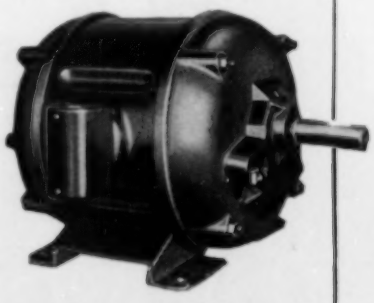
BUT WAGNER MOTORS CAN TAKE IT!

Motors that drive pumps and compressors find the going tough. They must overcome back pressures set up by fluids and gases—they are often required to make repeated starts and stops—they are sometimes kept in continuous service.

But Wagner Motors can take it. There is a motor correctly engineered to meet the requirements of every type of pump or compressor in the wide variety of types and sizes of motors in the Wagner line. More than fifty-five years of motor experience stands behind every motor bearing the Wagner name . . . and every motor built by Wagner reflects the value of this experience!

Twenty-nine sales and service branches, in principal cities, are ready to help you on any motor problem. Bulletin MU-185 will give information on the complete line of Wagner Motors.



Regardless of what your motor requirements may be—large motors . . . small motors . . . Wagner makes them all. Choose a Wagner motor for your next installation.

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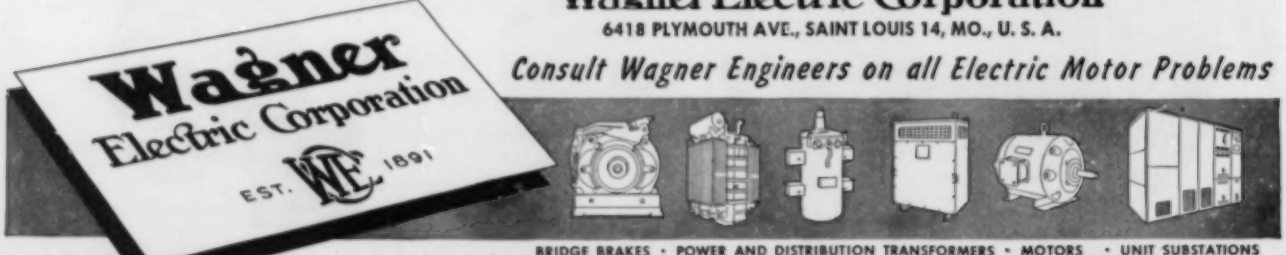
Consult Wagner Engineers on all Electric Motor Problems



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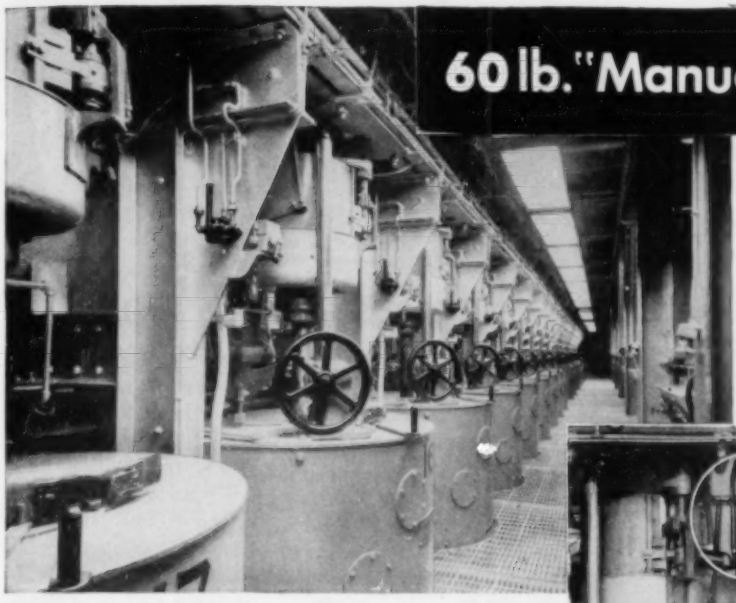
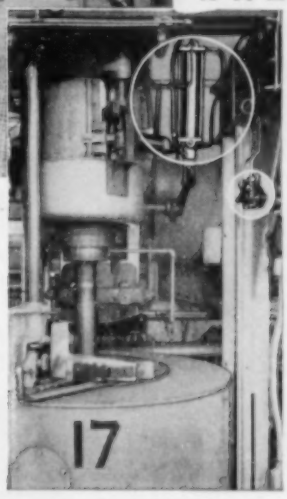
M48-17

ELECTRICAL AND AUTOMOTIVE PRODUCTS

60 lb. "Manual Lifts" *Eliminated*



Battery of 17 Roberts "Centrifugals," built by Western States Machine Co., installed in new $6,000,000 plant of Holly Sugar Co. plant near Brawley, Cal.



Close-up view of a Roberts Centrifugal shows a NOPAK Model E Air Cylinder which operates feed-pipe gate, and 3/8" NOPAK 4-Way Valve which actuates cylinder.

on 17 "Centrifugals" in New Holly Sugar Co. plant . . . by NOPAK Air Cylinders and Valves

A battery of 17 Roberts semi-automatic "Centrifugals" are employed in this modern plant to spin the molasses off the sugar crystals. To simplify the task of charging each centrifugal, the feed-pipe gate . . . which formerly required an awkward, manual lift up to 60 lbs. every 4 to 6 minutes . . . is now raised by the flick of a NOPAK Valve lever which controls a NOPAK Model E, 4x13" Air Cylinder.

In a normal 8-hour working day, over 1600 manual lifts of 60 lbs. each are eliminated. Machine operators are relieved of unnecessary strain and fatigue, and machine efficiency is maintained at the high level characteristic of this new $6,000,000 plant.

NOPAK Valves and Cylinders can help you achieve higher efficiency in your plant, or in your product.

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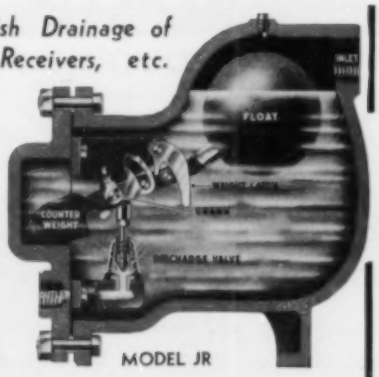
PREVENT FOUL AIR LINES

Due to Sluggish Drainage of Aftercoolers, Receivers, etc.



MODEL JR

Among the features of Nicholson weight-operated traps is the non-wire-drawing valve, which opens wide instantaneously to discharge, after which it closes tight—instantaneously. The attendant extra-large drainage capacity together with their ruggedness and leak-proof valve increasingly recommend Nicholson air traps where dependable drainage of water, oil and dirt, in possible volume, is a "must". Types for all applications, and for pressures to 1500 lbs. CATALOG 448

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Snap-Action Spring

provides powerful contact snap action and complete valve opening with air compressor switches at all ranges of operation—60 lbs. through 200 lbs. P.S.I.

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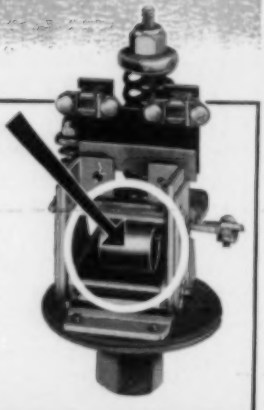

SQUARE D COMPANY

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WINNING POWER!

WISCONSIN HEAVY-DUTY *Air-Cooled* ENGINES

Four of a kind — winning power to spare in this hand! The same winning power you draw when you specify Wisconsin Air-Cooled Engines for your equipment . . . compact, heavy-duty singles in two types ranging from 2 to 9 hp.; twin-cylinder models from 7 to 13 hp., and V-type 4-cylinder engines from 15 to 30 hp.

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All models are extremely compact . . . to fit the machine as well as the job.

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World's Largest Builders of Heavy-Duty Air-Cooled Engines

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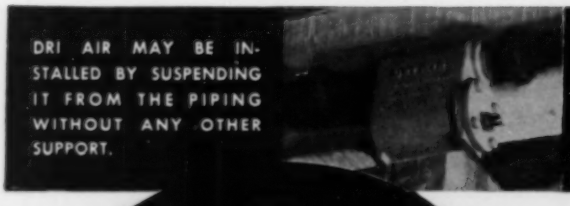
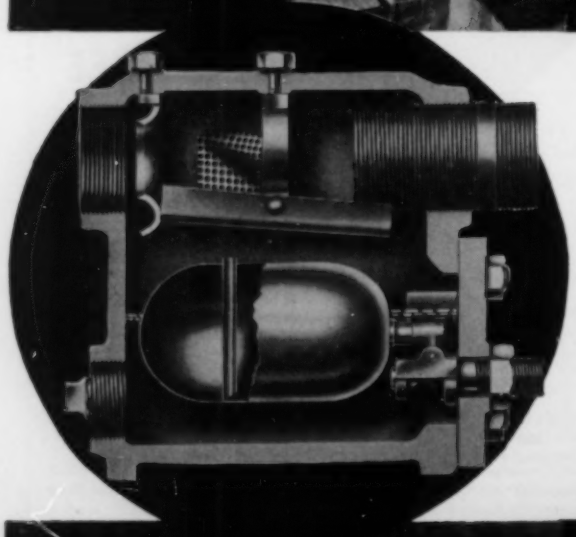


DRI AIR MAY BE INSTALLED BY SUSPENDING IT FROM THE PIPING WITHOUT ANY OTHER SUPPORT.

INCREASED PNEUMATIC EFFICIENCY WITH THIS AUTOMATIC SEPARATOR



PROTECT EQUIPMENT WITH

DRIAIR

SEPARATES • COLLECTS • DELIVERS

• DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

A TYPICAL INSTALLATION SHOWING DRI AIR STANDING ON A CONCRETE FLOOR NEXT TO THE WALL.

WRITE FOR BULLETIN DA WHICH FULLY DESCRIBES THE CONSTRUCTION AND OPERATION OF THE DRIAIR.

NEW JERSEY METER CO.

"SPECIALISTS IN COMPRESSED AIR DEVICES"

PLAINFIELD, NEW JERSEY

BURGESS SNUBBERS · BURGESS SNUBBERS

ASSURANCE OF A

• Quiet intake

Don't put up with troublesome pumping noise at the intake of your compressor or blower, or the discharge from a vacuum pump. Install the correct size Burgess Snubber and eliminate the noise problem easily.

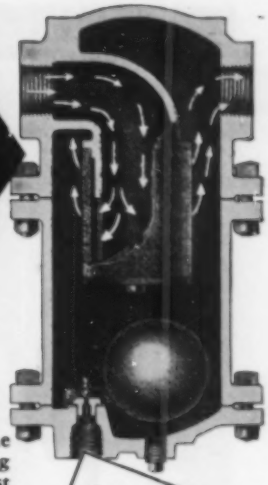
When you eliminate noise, you may also improve compressor operation, because a Burgess Snubber eliminates tuning pipe length to obtain best efficiency. It smooths the flow of air without choking or restricting air flow.

P.S. A Burgess-Manning Combination Air Intake Cleaner - Snubber is also available for air cleaning plus quieting. Write for full information.

BURGESS-MANNING COMPANY
749-P EAST PARK AVE., LIBERTYVILLE, ILLINOIS

BURGESS SNUBBERS · BURGESS SNUBBERS

NO MOISTURE OR DIRT GETS BY HERE



Johnson Separation Devices include Separators for Compressed Air or Steam. After coolers, oil absorbers.

Johnson Self-Draining Compressed Air Separator.....

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

1. Controlled expansion of air in separator precipitates most of the moisture.
2. A "thousand baffles" of coarse mesh repeatedly changes flow of direction to capture remaining foreign matter.

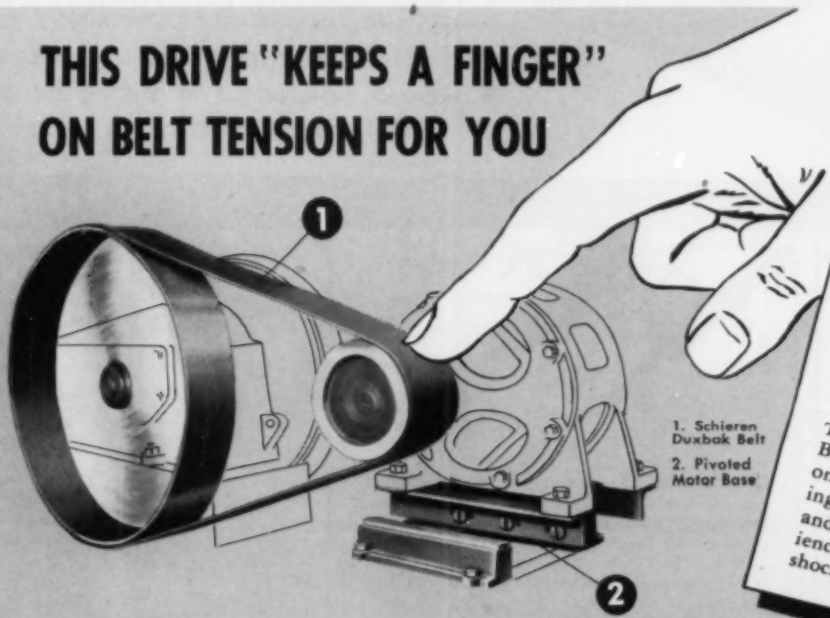
Self-Draining—a simple but complete trap mechanism built right in, automatically drains separator whenever necessary.

WRITE FOR CATALOG

The Johnson Corporation

830 WOOD STREET THREE RIVERS, MICH.

THIS DRIVE "KEEPS A FINGER" ON BELT TENSION FOR YOU



1. Schieren Duxbak Belt
2. Pivoted Motor Base

In this modern compressor drive, the PIVOTED MOTOR BASE gives you continuous, automatic control of belt tension. You simply set the base so that the belt is just tight enough to overcome peak loads . . . from then on, the base maintains that tension.

This eliminates belt-tightening guesswork that results in bearing abuse. You can predetermine the proper belt tension and continuously maintain it.

The SCHIEREN DUXBAK BELT makes things even easier on motor and compressor bearings. It has extra pulley grip and a slow, cushioning resiliency that enables it to absorb shocks and sudden overloads.

Write for further information on Schieren belting and the modern pivoted base short center drive or on other Schieren products mentioned below.

SC-31

CHAS. A. SCHIEREN CO., 35 Ferry St., New York 7, N. Y.

Branch Offices in Chicago, Dallas, Denver, Detroit, Newark, New York, Philadelphia, Pittsburgh, Salt Lake City and Toronto, Canada

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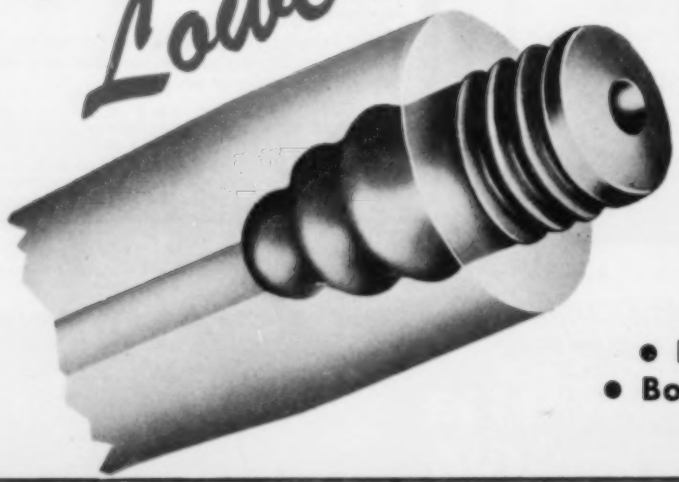
Leather Packings Leather Belting Leather Specialties

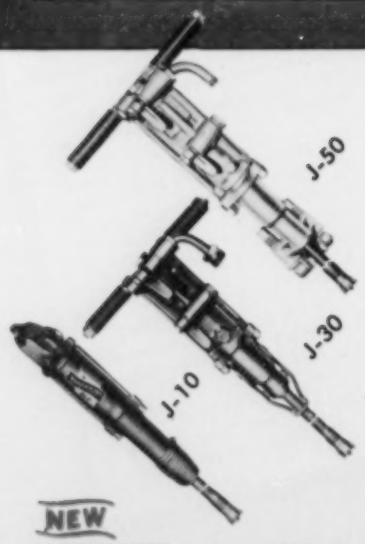
The Outstanding Contribution to Lower Cost Mining . . .



CARSET JACKBITS

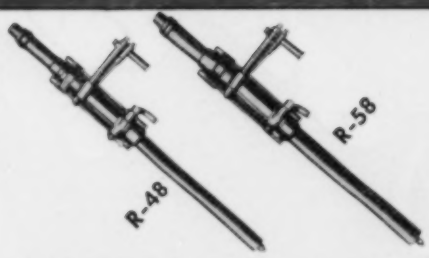
Manufactured exclusively by Ingersoll-Rand Company

• Drill Faster • Wear Longer
• Boost Tonnage • Save Powder
• Reduce Maintenance



NEW

JACKHAMERS — Ingersoll-Rand makes a Jackhamer for every need and type of work. The new powerful J-10 Utility Jackhamer that weighs only 14 pounds has many applications in the mining industry. Carset Jackbits permit unheard of production when used with any size I-R Jackhamer.



STOPEHAMERS — Ingersoll-Rand Stopehamers are available in two sizes. These balanced machines have established records for durability and high drilling speeds. Here again Carset Jackbits will boost tonnage and considerably reduce bit changes.

DRIFTERS—Three famous Ingersoll-Rand Drifters—the DA-30, DA-35, and the D-505 are turning in record performances the world over. Tunnel contractors report less time per round and more time for mucking with Carset Jackbits.

NEW

WAGONJACK—A Jackhamer or light drifter mounted on this lightweight wagon mounting will drill twice as many feet of hole per shift as when held by hand. It holds the bit down to the rock. When used with Carset Jackbits and long feeds, production is even greater.

CARSET COMBINATIONS

MAXIMUM PRODUCTION AT MINIMUM COST

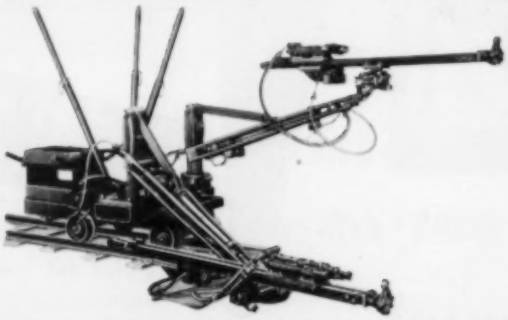
In ground where steel bits are drilling *two to ten feet per bit usage*, CARSET JACKBITS manufactured exclusively by Ingersoll-Rand are *averaging from two hundred to more than a thousand feet*. The smaller sizes beginning at 1⅜" are setting new production records in tunnel driving and mining. The revolutionary QUARRYMASTER on one prominent installation with 5½ inch CARSET BITS is drilling over one thousand feet of hole per bit. This is in ground that could not be drilled economically with conventional large hole drills.

Combine the sensational features of CARSET JACKBITS with proven Ingersoll-Rand Jackhamers, Drifters and Stopehamers. Use CARSET BITS with long feeds on the new labor-aiding, cost-saving Quarrymaster, Boom Jumbo and Wagonjack.

Carset Combinations are recommended for highest overall efficiency. Increased production and shorter drilling time mean substantial savings in overhead. Consult our experienced drilling engineers—Ingersoll-Rand mining machinery is sold by men who know rock drilling.

NEW

BOOM JUMBO — Developed by Ingersoll-Rand engineers with air-powered booms to meet the ever increasing demands of management and labor for greater production with less effort and lower costs. For highest production use it with long feeds and Carset Jackbits.



NEW Ingersoll-Rand QUARRYMASTER

A heavy duty air-powered drill for open pit, stripping and quarry work. With 6" Carset Jackbits, it drills hole after hole with practically no time lost in changing bits or cleaning cuttings from the hole.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

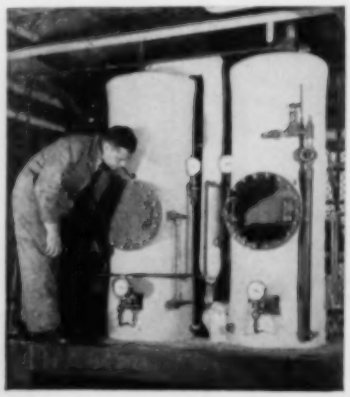
337-15

I-R PRODUCTS FOR THE MINING INDUSTRY—Mobil-Air Compressors, Stationary Compressors, Paving Breakers, Stud Jackbits, Drill Sharpeners, Drill Steel Furnaces, Jackmills, Jackbit Grinders, Sump Pumps, Slusher Hoists, Airlite Generators, Centrifugal Pumps, Diesel Engines, Blowers.

HAVE YOU A FRESH WATER PROBLEM?

Any evaporator can produce fresh water, but what you want is efficiency. Scaling, the big headache, is reduced to a minimum in Maxim Evaporators because of their very high circulation rate. When descaling is necessary a unique design feature allows quick and easy descaling, cutting down time by hours.

Maxim Evaporators are extremely compact . . . automatic in operation, and produce fresh water to a purity of 2/10 grains of solid per gallon, or 3½ parts per million. They are available in single or double effect. The two evaporators shown produced on test 2500 gals. per day and higher capacities are possible. Investigate these very efficient evaporator units.

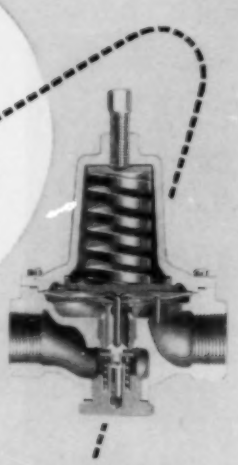


SEND FOR BULLETIN
Eight pages of information, detailed drawings, diagrammatic hook-ups, single and double effect.

THE MAXIM SILENCER COMPANY
61 HOMESTEAD AVE. HARTFORD 1, CONNECTICUT

BE SURE IT'S A
MAXIM

THE KEY TO CORRECT AIR PRESSURE

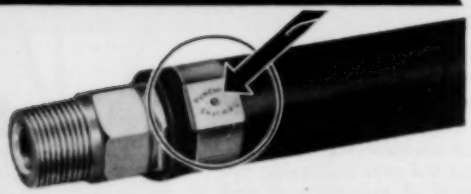


NORGREN REGULATORS deliver smooth, even air at the CORRECT pressure. *Floating diaphragm* assures flexibility, quick decisive action, long life. *Baffle plate* cushions diaphragm against shock. *Syphon tube* permits larger volume of air to pass with less pressure drop than conventional regulators.

Write to
C. A. NORGREN CO.
222 Santa Fe Drive
Denver 9, Colorado

Norgren

TODAY'S BEST BET FOR SAFETY in Air Hose Connections

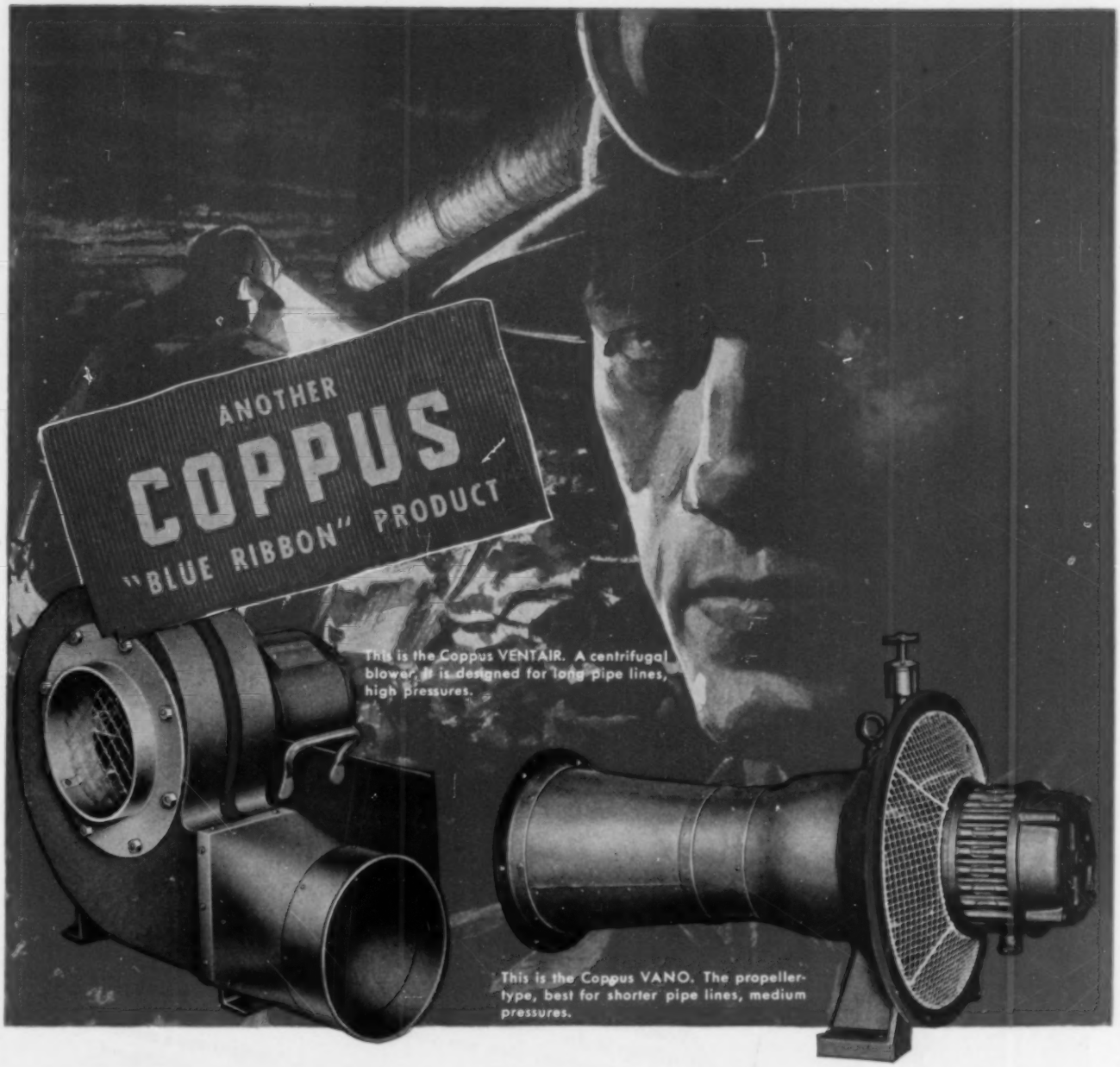


The Punch-Lok Method for clamping hose is approved and used as original equipment by manufacturers of compressors, rock drills, and other air-operated tools. Punch-Lok Clamps are leakproof and lay flush with hose cover. They are safe, efficient, and low-cost.

Write for Punch-Lok Catalog. See for yourself the hundreds of other miscellaneous applications of this simple banding method.

Look . . . it's Punch-locked for Safety

PUNCH-LOK COMPANY
Dept. C, 321 N. Justine St., Chicago 7, Ill.


ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT
This is the Coppus VENTAIR. A centrifugal blower, it is designed for long pipe lines, high pressures.
This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.

These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corp., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
211 Park Avenue, Worcester 2, Mass.

Please send . . . . . Bulletin 130

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to the uses for HANSEN COUPLINGS

NEEDED IN EVERY FLUID LINE

Economies are created in every plant by the use of HANSEN couplings in fluid lines. The quick-connective and shut-off features of these couplings save you time and money, and the variety of jobs they do is endless.

HANSEN couplings make connections and change-overs a matter of seconds. Costly operations are not interrupted . . . equipment continues to produce. Connection is made by pushing plug into socket . . . flow starts at once, automatically. Slight movement of the socket sleeve releases plug, and supply line is immediately sealed . . . one-way or two-way shut-off. For applications where no closure is desired, a "straight through" series has been designed. Each HANSEN coupling is engineered for the service for which it is recommended, and there is no limit to the uses for HANSEN couplings in these services.

Write for Industrial Catalog No. 47

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QUICK CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

GREATER MACHINE OUTPUT AT LOWER COST

with RHOADS

Tannate-Rockwood

SHORT CENTER DRIVE

"Be sure to visit Booth 269-271 at the Power Show - - Nov. 29 to Dec. 4, 1948 - - at New York City."

Constant, uniform speeds . . . fewer shutdowns . . . less wear on bearings and belt are assured by Rhoads TANNATE-ROCKWOOD Short Center Drives. Pivoted motor base automatically maintains correct belt tension regardless of load fluctuations . . . Tannate Leather Belt assures long, trouble-free belt life, requires fewer take-ups, less maintenance, resists high temperatures, moisture, machine oils and many chemicals.

This dependable, efficient combination operates horizontally, vertically or at any angle . . . Write for details. (*Order your Tannate-Rockwood Drive from your compressor manufacturer.*)

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Hydraulic Packings and other Mechanical Leather Products

GREATER EFFICIENCY AND ECONOMY

Get both by lubricating your compressors with Texaco

Photo courtesy Joy Mfg. Co., Sullivan Division.

GIVE your compressors effective lubrication — *Texaco* — and they'll deliver full volume and pressure for extra hundreds of hours between overhauls. Texaco has a complete line of lubricants to assure greater efficiency and economy for compressors of every size and type under all operating conditions.

Texaco Cetus, Alcaid and Algol Oils, for instance, have all been specially processed to remove impurities that form hard carbon and gummy deposits.

They keep valves clean, rings free, ports open and air lines clear — greatly reduce the need for repairs, replacements and overhauls.

For compressing wet air, use *Texaco Regal Oils (R & O).* They give full protection against rust formation — even during idle periods and in intermittent operation.

To make your drills last longer — run more efficiently and economically — use *Texaco Rock Drill Lubricants EP.*

A Texaco Lubrication Engineer will gladly help you select the best Texaco lubricants for your particular needs. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write:

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TEXACO

TEXACO Lubricants

FOR ALL AIR COMPRESSORS AND TOOLS

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